THE MODEL ENGINEER

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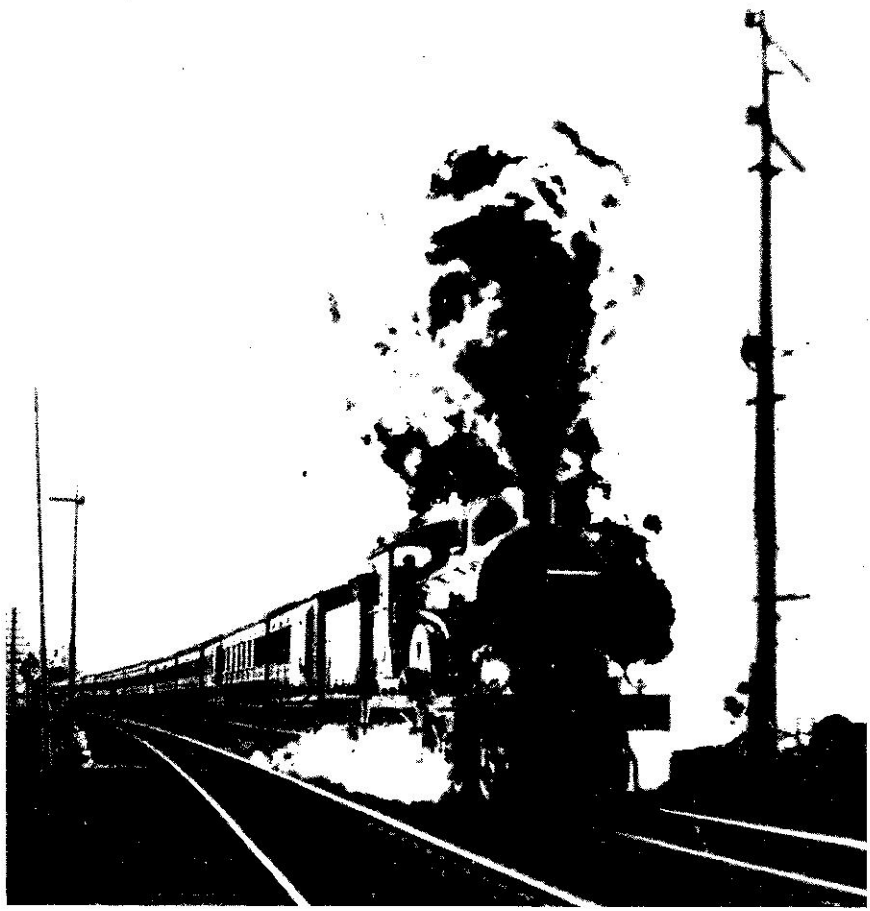

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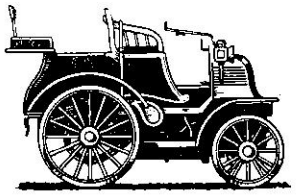

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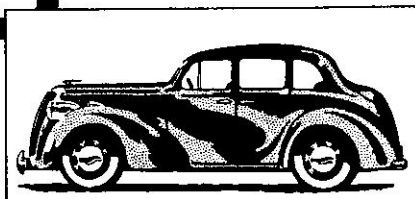

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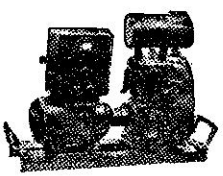

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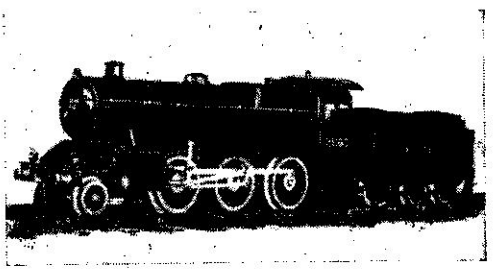

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THE

MODEL ENGINEER

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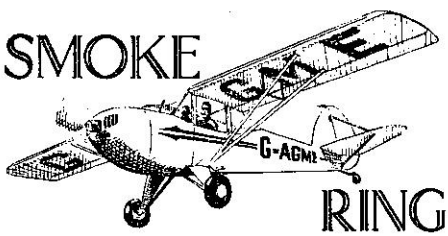
VOL. 95 No. 2360. AUGUST 1st, 1946



Locomotives at the "M.E." Exhibition

AFTER the lapse of so many years since the previous exhibition was held, we would naturally expect to find an influx of newcomers to the forthcoming show; and so it will be. Among the Competition models will be one which, according to the entry-form, is described simply as "a new design of locomotive," which arouses some curiosity as to the shape and appearance of this novelty. At the moment of writing this note, only one competitor would seem to have responded to the recent appeal to electrically-minded readers for some interest to be taken in electric traction; this solitary example takes the form of a 2½-in. gauge replica of the *ex*-N.E.R. electric freight locomotive, No. 12; and we have yet to see how its performance compares with an equivalent steam locomotive on the passenger-carrying track. For the rest, the exhibits are more orthodox in character, with the possible exception of what is described as "a free-lance *Agenoria*," which sounds intriguing. A 10-mm. scale Aveling & Porter Tramway locomotive should prove to be an unusual exhibit, in view of the comparative rarity of the prototypes in this country. The ¾-in. scale L.M.S. "Princess" class 4-6-2 engine named *Percival Marshall*, illustrated in our pages last March, has been entered as a competitor, and should add a spice of keenness to the contest. The number of regular stalwarts which will operate the passenger-carrying track will be augmented by the addition of a few which will be making their bows to the public; and it is interesting to note that some of these will be miniature replicas of old-time prototypes. These "old boys," however, are mostly of recent construction, embodying modern features, which were unknown to the prototypes, but, in the miniatures, have been skilfully applied in such a way as not to modify the true prototype appearance. Among the Trade stands, too, will be found new ranges of castings and parts for miniature locomotives, as well as new items to interest the model railway fraternity. Progress in this direction is not so rapid as we all had wished, and has lately suffered a severe setback, due to the re-imposition of controls by the Board of Trade. This has played havoc with the post-war development plans put in hand by our commercial friends. Clubs and Societies catering for the model railway hobby are to be well represented, and will exhibit examples of members' recent work ranging from complete working model railways to various individual items of equipment. Some of the well-known clubs may not be actually represented this time, owing to local difficulties retarding re-organisation, but the number of clubs, old and new, is steadily increasing and their members are certain to visit our exhibition in full strength. Among the Loan exhibits, too, there will be several excellent locomotives, some of them ranking among the finest examples of their kind; and these serve to stimulate not only enthusiasm, but an actual desire in many onlookers to "go and do likewise." That the locomotive and railway interest will be more than well catered for in the twenty-first MODEL ENGINEER Exhibition, is abundantly evident; the signals are "all clear" for a good run through the period of the show.

Calling Mr. Pickles

I HAVE a letter on my desk from Mr. W. Pickles, which I am unable to answer, as he gives me no address.

An Exhibition at Slough

FROM the 3rd till the 10th of August, the Slough and Windsor District Holiday Carnival will be held at Agars Plough (Eton College Playing Fields), Windsor Road, Slough. In connection with it, the Slough and District Society of Model Engineers has organised an exhibition of models of all kinds. Judging by what has been seen at previous functions held by this Society, some excellent work will be on view. A passenger-carrying track will be in operation during the week, the locomotives being loaned for the purpose by Messrs. F. S. Allwright, C. Hammond, W. Nixey and S. Sykes.

Percival Marshall

Ship Modellers' Corner

By Edward Bowness

Constructional details of the masts, yards and booms for the model 4-mast barque "Archibald Russell"

BEFORE we go further we must describe the method of building the topmasts and topgallant masts in one, as promised in the issue for June 13th. The sketch (Fig. 61) gives the dimensions of the combined mast. The hollow between the masts at the doubling should not be overdone or the wood will split along this line. Clearance should be cut at the bottom of the doubling as shown, to make space for the shrouds. With this method it is impossible to use the wooden knitting needles recommended for the other method. For my *Cutty Sark* model, in which I made the upper masts in one, I used sycamore, $\frac{1}{8}$ in. thick, selecting a piece with as straight a grain as possible. The block of wood which represents the trestle-trees is drilled $\frac{1}{4}$ in. diameter for the topmast, and is slipped over the lower end and pushed up to the butt of the topgallant mast. The clip at the cap of the topmast is exactly the same as that described already, as is also the general process of erection.

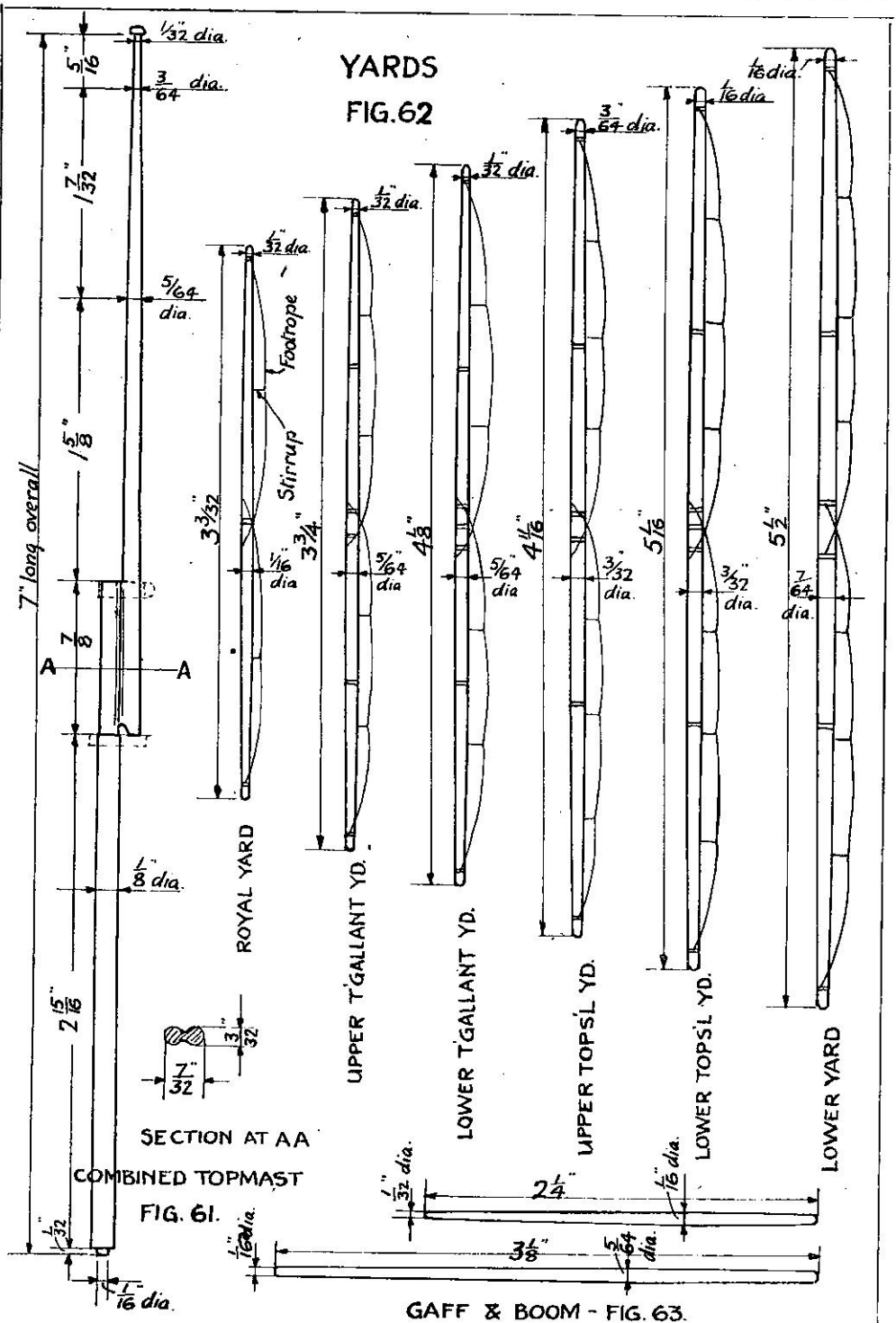
Yards

The yards should next be made. Fig. 62 gives the dimensions, and as the yards are the same on all three masts we will require three of each, or eighteen in all. The diameter at the centre diminishes but little for the central half of the yard, most of the tapering being done on the outer quarters of its length.

As to material, if knitting needles of suitable diameters can be found, well and good, but I fancy that in these days of shortages it may be difficult. Split bamboo is a very suitable material, especially for the upper yards, as it is very strong and takes on a good finish. Sycamore is also very useful and, after bamboo, I consider it the best material. I have also found cedar very satisfactory, especially that used in pre-war pencils. If the wood is obtained in the form of thin boards, say $\frac{1}{8}$ in. thick, it should be split until straight pieces are obtained of the required length. These lengths should then be squared and tapered to the required dimensions before removing the corners. When the corners are removed and the spar is approximately round, one end can be rotated between the finger and thumb while the other is rubbed down with glass-paper. By changing over to the other end and repeating the process, a nicely rounded and tapered spar can be produced. Finish with the finest glass-paper, and finally burnish with the plain side of the paper. The middle portion of the royal yards, which were made of wood, was octagonal in section for two or three feet, but this may well be ignored at our scale.

Photo by [*Clement A'Court*

Plan view of 4-mast barque, showing setting of sails



SPARS FOR "ARCHIBALD RUSSELL" MODEL – FULL SIZE. E.B.

The line near the end of the yards in Fig. 62 indicates the point of attachment for the braces and lifts, and the portion outside this is technically the yardarm. In older ships the yardarm was much longer than that shown, but when iron and steel yards were introduced, it was shortened very considerably.

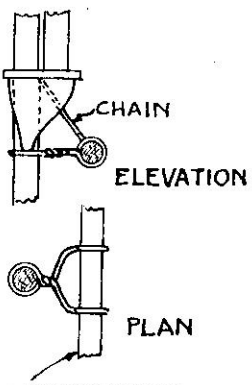


FIG. 64.

The boom and gaff for the spanker should be made to the dimensions given on Fig. 63, the materials and method being the same as for the yards. Note that the greatest diameter for both the gaff and boom is at about one-third of the length from the butt, and that the boom has very little taper as compared with the gaff.

The drawing of the yards shows the foot ropes, but whether or no these are fitted depends on the modeller. They were supported by stirrups, short pieces of wire rope 3 or 4 feet long, which were spliced to the jackstay, a steel bar fixed to the top of the yard for the attachment of the sails.

In the model the stirrups are made of short lengths of fine wire pressed into the yards where shown, and it will be found convenient to make the foot ropes also of wire, soldering them to the ends of the stirrups and fixing the ends to the yards.

The lower, lower tops'l and lower t'gan'sl yards are fixed as to height, being carried from the masts by swivels or cranes. These were described in some detail in the Ship Modellers' Corner in the issues for October 28th and November 25th, 1943, as also were the parrels and halliards for the other yards. In a model of the scale to which we are working, it is almost impossible to show these in detail, although after seeing the amount of detail some builders can introduce into a model, it would be rash to say what is possible and what is not. However, the method we describe will give a reasonable effect and should be well within the capacity of the average modeller.

Constructing the Yards

The sketch (Fig. 64) shows the fitting for the ower yards. It consists of a length of wire 24 gauge by $1\frac{5}{8}$ in. long which is fixed around the lower mast at the anchorage for the futtock shrouds. The ends are twisted together and bent to a U form in plan with the ends of the U pointing forward, and spaced $\frac{5}{16}$ in. apart. These ends are then bent around the yard. Note that if the model is shown with the sails furled the yards should be squared at right-angles to the centre-line of the hull, whereas if it is to be a waterline model with sails, then the yards should be swung around at about 45 degrees, the upper yards being set at a greater angle to the centre-line of the hull than the lower ones. This is clearly shown in the photograph reproduced with this article. This photograph was taken from a 1/32-in. scale model of *Herzogin Cecilie*, made some years ago by the writer, and illustrates clearly the relative setting of the upper and lower yards.

To assist in supporting the great weight of the lower yards, a stout chain was fixed to the mast below the mast top, and shackled to an eye on the top of the yard. This can be represented by a short length of wire, or even a splinter of bamboo, glued in position as shown in Fig. 64.

The lower topsail yard is carried in the loop of wire which was left when fitting the clip at the top of the lower masts, the ends of the wire being bent around the central part of the yard. The same fixing is used for the lower t'gan'sl yards, which should be fitted after the upper topsail yards are in position. Additional support is given to the lower topsail yard by a steel strut from the mast top. It is forked and pinned so as to be free to follow the movements of the yard. In the model a piece of wire or split bamboo glued in position will represent it satisfactorily. (See Fig. 65.)

The "Arethusa"

At this stage of our model, the photograph of the *Arethusa* which we reproduce, will be of interest. As many of our readers will remember, she was originally the *Peking*, one of the famuos "P" line of sailing ships. A few years before the war she was purchased by the Shaftesbury Homes for Boys to replace their old ship *Arethusa* as a training ship. She was renamed *Arethusa*, and accommodation was built into her 'tween decks, resulting in the row of ports which will be seen in the photograph between her painted ports. During the war her masts were lowered and her yards taken down by the Navy when they took her over for use as a depot ship at Sheerness. However, her spars were taken good care of, and she is now being rigged to her former condition as shown in the photograph. To reduce weight aloft, the upper topsail and topgallant yards were dispensed with, which accounts for the small number of yards. It will be noticed that her lower and topmasts are in one piece, and that the jigger mast is a single tube from deck to truck. But the fixed yards are in their normal position, the lower topmast topsail yards being carried

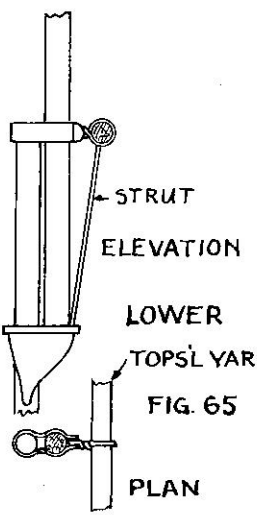


FIG. 65

just where the cap of the lower mast would come in the older style mast. Those who are interested, and who are within reach of Upnor, where she is moored, would do well to pay her a visit and study from an actual vessel the various points which we have been discussing. The photograph of the ship was taken by Mr. R. A. Brimscombe, of Gillingham, Kent, who very kindly sent us a print on reading the *Archibald Russell* articles.

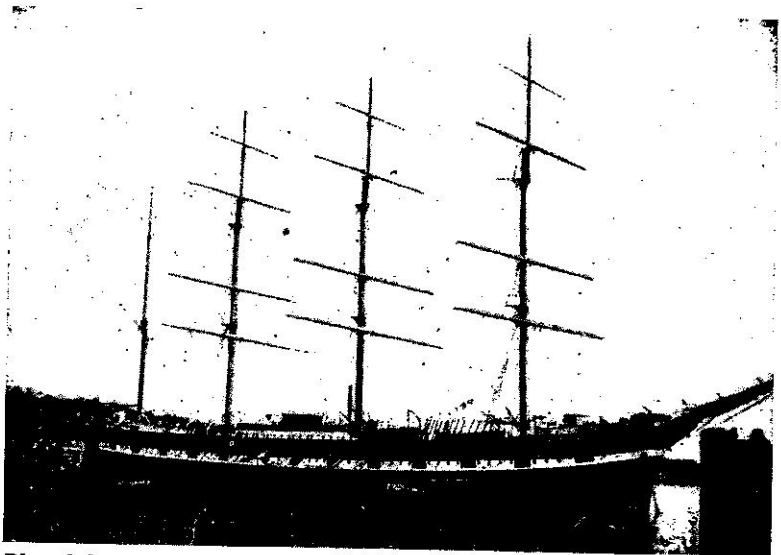


Photo by] *The training ship "Arethusa"* [*R. A. Brimscombe*

A Modern Windjammer

The other day one of our Ship Model Club members rang me up and enquired if I had seen the three-masted schooner which was lying at the docks. I hadn't, and as a sailing vessel is somewhat of a rarity, even in Bristol, and seems to be becoming more so as time goes on, I took the first opportunity of seeing her. There she lay, the *Tessy* of Vastervik, Sweden, looking very trim and smart in her clean grey paint, and with tall, tapering masts. At a glance I could see she was not one of our old-time British sailing coasters. Theirs is a beauty of graceful lines and lovely proportions, and owes nothing to smartness or paint. This was just the reverse. The hull was designed on strictly utilitarian lines, the graceful curves of the old wooden schooner having been straightened out somewhat to simplify the steel construction. The stem was straight and sloping forward, and the bows had a considerable amount of flare. The stern was somewhat like the cruiser stern of the modern steamer.

The masts were tall steel tubes, stayed in the ordinary way with shrouds and stays, but instead of ratlines in the shrouds, a Jacob's ladder was built on each mast. A wireless aerial stretched between the fore and main masts, and one could imagine the wheel house or chart house on the poop being fitted with all the latest navigational appliances. There was no one about when I went on board, so I was unable to investigate as far as I could have wished.

She had auxiliary power and a funnel just abaft the mizzen mast. To protect the sails from the fumes from the engine (Diesel, I presume), three pipes were led from the funnel to the port shrouds. This also brought them out of the way of the boom when it was hauled out on the port side. The fore and main gaffs hung down from their normal position, and their respective sails were brailed up to them. The fore and main booms were being used as derricks, and below them were two great hatches filling the space between the masts. The poop was raised and a chart- or wheel-house almost filled the deck, leaving only space for the life-boats, one on either side. The life-boats were varnished not painted, and looked very smart. Through the port holes I could see something of the accommodation below, and it seemed to be roomy and clean. There was an air of cleanliness, smartness and efficiency about the entire vessel which, I regret to say, is usually lacking in most of the British sailing coasters I have seen. The builders of the *Tessy* were Kalmar Varv, and the name-plate showed she was built in 1944.

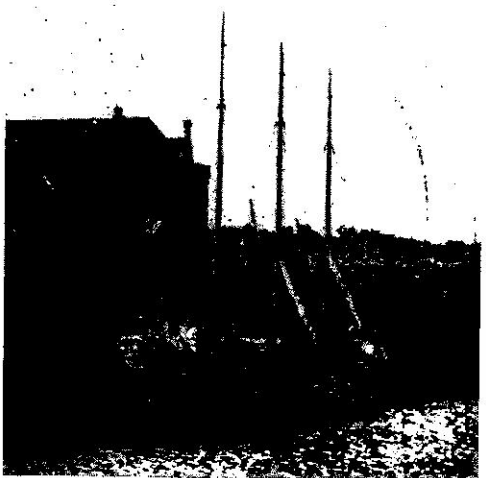
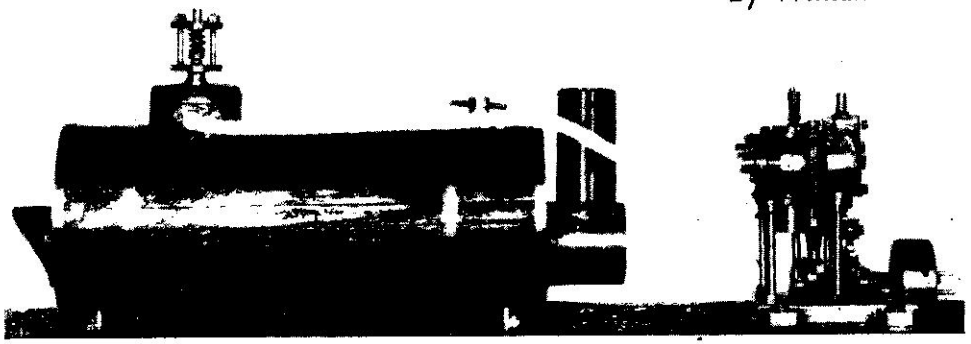


Photo by] [*E. Bowness*

The Swedish 3-mast schooner "Tessy"

A SIMPLE MARINE BOILER

By William White



IN THE MODEL ENGINEER dated February 14th, there appeared a photograph and description of a ¾-in. × ¾-in. single-acting steam engine I had then completed.

Since then, I have made the boiler, and, for the benefit of any reader who may have thought the engine worth while building, here is a photograph and sketch of the finished unit.

As will be seen from the photograph, the boiler is of the centre-flue type, made of copper throughout and brazed.

The flue-tube has eleven cross tubes brazed in and spaced ⅝ in. centres, starting from the after end.

The only fittings are the safety-valve and filling-plug (both home-made), these being screwed into bosses filed on one side, to the radius of the boiler, and sweated on.

A small screw is screwed into the forward end-plate at water-level to act as a test-cock when filling. The boiler is lagged with strips of hard wood ⅜-in. broad; these are varnished and held in position by ⅛-in. brass banding.

The wood was first held in position by two clamps made of slightly heavier brass and tightened by a screw passing through two lugs.

When the clamps had been screwed up and the wood drawn tightly and evenly against the boiler, four pieces of brass banding were cut long enough to give ½ in. of overlap when wound round the wood. The ends of each band were then tinned and the ends sweated together while holding the band tightly in position. A touch with the soldering-bolt is quite sufficient to sweat the ends together without burning the wood. The soldered joints on the bands were, of course, kept to the bottom, where they are out of sight.

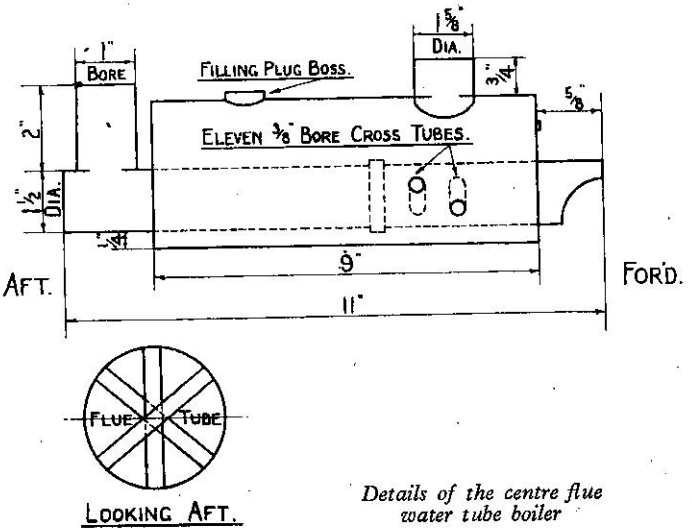
Through the joints of the two centre bands a hole was bored and tapped 3/32 in., and a stud screwed in, long enough to pass through the base and keep the boiler in position on two stools made from ⅜-in. brass angle secured to the base.

The steam and exhaust pipes are lagged with asbestos string and painted white. The steam-pipe flange is secured to a brass saddle pinned and sweated to the steam dome.

When testing the plant, I used an ordinary bunsen burner attached to the gas-pipe from the stove; but, of course, when I come to instal the plant in a three- or four-foot boat, a suitable blowlamp will be required.

The boiler steams well and can maintain the engine at high speed for 30 minutes, and still have something in reserve.

The photograph was taken by Mr. Herbert Booth.



Details of the centre flue water tube boiler

*MILLING IN THE LATHE

Section 1—Milling Cutters

A general review of the principles, appliances and methods employed for adapting the lathe for various types of milling operations

By "NED"

ALTHOUGH there is no essential difference between the milling cutters used on a machine specially designed for this class of work and those used for milling in the lathe, it is proposed to consider the subject of cutters primarily from the latter aspect and, in particular, to show how the lathe user can make the most of a very limited variety and number of cutters, or even produce simple forms of cutters which will serve his purposes as efficiently as those of the ready-made type. The forms of cutters which are designed particularly for heavy work, or for the rapid removal of metal at high rates of feed, speed and power, are of but little interest to the lathe user, because, as we have seen, neither the power nor the rigidity of the ordinary lathe is adequate to do justice to them ; but on the other hand, true

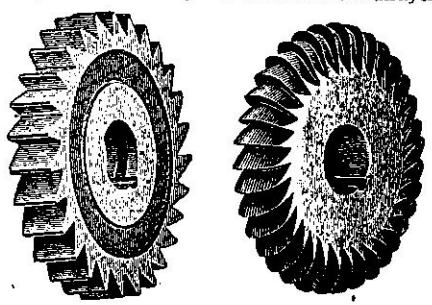


Fig. 2. Slotting cutter and convex form cutter

cutting efficiency, in the sense of carrying out work rapidly with the minimum expenditure of power, is of the utmost importance for lathe milling, and it is quite impossible to produce either accurate or well-finished work with inefficient cutters.

One of the arguments often raised against any form of milling operation is that it entails the use of expensive cutting tools, and that a wide variety of such tools is necessary to cover a normal range of operations. This objection certainly applies in cases where cutters must be bought, and where the special cutter for a particular operation is insisted upon ; but it is not necessarily true if one is prepared to exercise a little ingenuity, or even plain common sense, in the adaptation of available cutters, or the construction of cutters to suit emergency requirements.

Types of Milling Cutters

It is possible to class nearly all forms of milling cutters under three general headings :

*Continued from page 57, "M.E.," July 18, 1946.

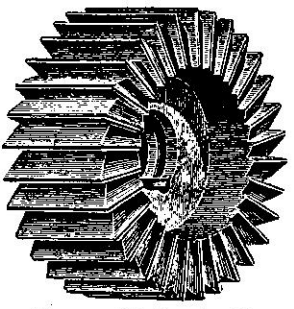


Fig. 3. Shell end-mill

(1) Those with radially projecting teeth, designed to cut on the periphery only ; (2) those with endwise (axially) projecting teeth, which cut on the end face only ; and (3) those which combine forms (1) and (2) so that they can be used in either capacity, or in which the teeth are set at an intermediate angle for bevel cutting. Class 1 includes cylindrical milling cutters for plane milling of flat surfaces, also narrow disc cutters for slotting or keyway cutting, and practically all varieties of form cutters, such as those used for cutting gear teeth and similar profiles (Fig. 2). Class 2 comprises the very wide variety of cutters known as "end mills" or "slot drills," and when of large diameter, these are termed "face mills," or "shell end-mills," the latter term being generally applied to a short, hollow cutter designed to be mounted on an arbor (Fig. 3). Class 3 is perhaps the most versatile class of all, including "side and face" cutters which can be used for either peripheral or end-face cutting, or for tee slotting, dovetail cutting, and the formation of vee slides, angular grooves, etc. (Fig. 4). Most modern end mills are provided with side cutting teeth, though their efficiency to cut in this direction is limited, and, generally speaking, only the tips of the side teeth are used. It should, however, be pointed out that no end mill could work at all, except in the capacity of a spot facing cutter or counterbore, without some ability to take a

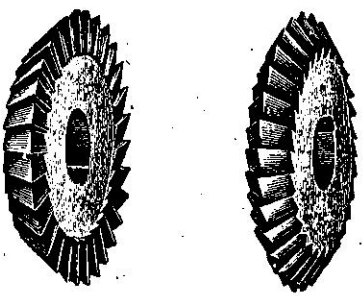


Fig. 4. Bevel cutter and vee-angle cutter

shallow side cut. These observations on cutter design are elementary, but may help us to understand the principles involved in the various milling operations.

Number of Teeth

Milling cutters may have any number of teeth, from one upwards, the single-toothed type of cutter being generally known as a "fly-cutter." This type has obvious limitations in cutting efficiency, since the rate at which it can remove metal is restricted, and in most cases it is only in contact with the work for a brief part of a revolution; moreover, the load fluctuation caused by intermittent cutting may set up serious vibration

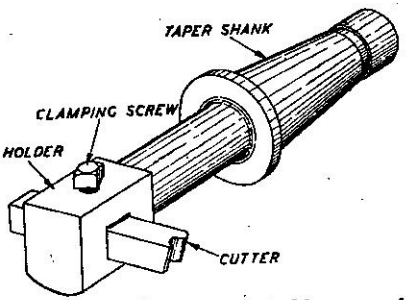


Fig. 5. Form of fly-cutter holder as used in milling machines

or "chattering." Nevertheless, the simple fly-cutter should not be despised, as it is the simplest of all cutters to make or adapt, and it is applicable to many problems, especially in form milling, which would otherwise require an elaborate and expensive special cutter. In cases where the rate of removing material is not the prime consideration, single-point cutters are useful, even in production work.

It is logical to expect that increasing the number of teeth in a cutter will improve its cutting efficiency, since each of the teeth is capable of contributing to the work; but the idea that the cutter having the largest number of teeth will be the most efficient is a fallacy. Some of the first milling cutters used had very fine-cut teeth, being practically rotary files, but it was soon found that a smaller number of teeth gave better results. In the first place, a difficulty arises in keeping a large number of teeth in proper cutting condition; it is also necessary to provide proper chip clearance between the teeth, so that the cutters do not become clogged; and it is also found that taking fairly deep bites with a cutter having few teeth is better than taking a mere scrape with a fine-tooth cutter, absorbing less power and producing less heating or general wear and tear.

The exact number of teeth most suitable for a milling cutter depends to a great extent on its size, speed, and general conditions of duty. Most cutters give their best results when each tooth is removing the amount of metal best suited to its rake and clearance angles—just as a drill has a "natural" rate of cut at which it works most comfortably and lasts longest.

It is logical that small, high-speed cutters, especially those used on soft metals, should work best with few teeth, whereas larger and slower cutters may utilise a larger number of teeth with advantage. Within the class of work dealt with here, it is rarely advisable to use a cutter having more than about twelve teeth. The importance of running cutters of any kind dead truly will be appreciated, because it is only in this way that each tooth can be made to contribute its full quota of work. A cutter running very badly out of truth may, in fact, only be cutting on one tooth; and in that case, it would only be functioning as a fly-cutter, and a rather inefficient one at that.

Cutter Grinding

One of the difficulties which the amateur or small shop operator encounters with milling cutters is the problem of grinding them properly. It should be emphasised that this can only be carried out by means of a grinding machine equipped with means of indexing the cutter teeth and grinding them all exactly alike. Suitable attachments to an ordinary tool-grinder may serve this purpose, but attempts to sharpen the cutters without such aids are almost inevitably futile, and generally result in spoiling them completely. It is, however, practicable to touch up the teeth of a cutter which is only slightly dull by the use of a fine carborundum or oilstone slip.

Single-point Cutters

An ordinary lathe boring-bar, designed to run between centres or in the chuck, can be adapted to carry a single straight cutter for peripheral milling, or an angular, offset or bent tool which will act as a "side and face" cutter. Generally speaking, however, the scope of a bar of this type is rather limited, unless it is designed in the first place to cover this particular class of work, which often involves the use of cutters of greater length and heavier section than those employed for boring. The form of holder generally used to take fly-cutters on milling machines, as supplied by several of the leading makers, is as shown in Fig. 5. It will be seen that the shank is heavy to promote rigidity, tapered to fit the milling machine spindle, and equipped with a draw-in bolt (not shown) to secure it in position. Note that the cutter is fitted so that its edge falls on the diametral centre line, in order to simplify the measurement

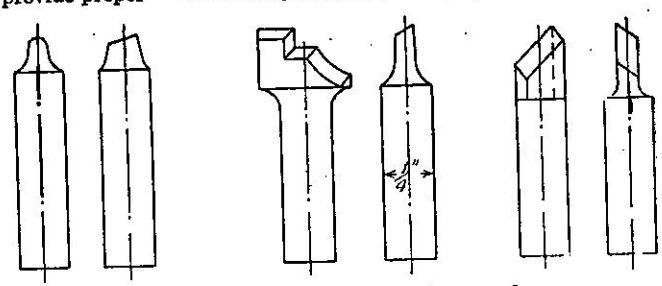


Fig. 6. Form cutters for use in cutter bar

of rake and clearance angles of the cutter. Examples of form cutters suitable for use in a holder of this type are shown in Fig. 6.

The simple cutter holder shown in Fig. 7 has been referred to in THE MODEL ENGINEER several

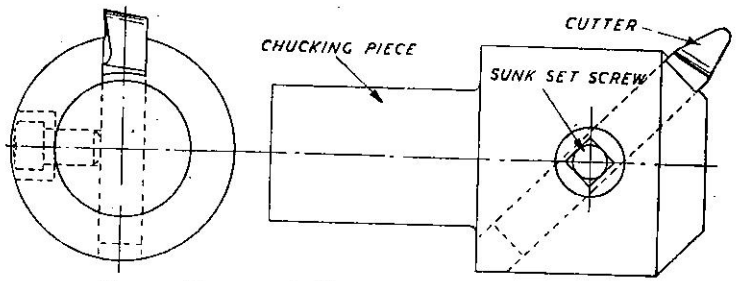


Fig. 7. Fly-cutter holder for mounting in lathe chuck

times in the past, and is one of the handiest, both to fit and apply to work, in the small lathe. By fitting the cutter at an angle of about 45 deg. to the axis, it can be used for both side and face work, and various shapes of tool points may be used.

Some forms of tool-holders used in normal lathe practice can be adapted to carry rotary fly-cutter bits by mounting them in the lathe chuck, or on the faceplate, so that the cutter projects and works in an orbit of the required radius. A special holder for carrying a tool in this way was marketed some years ago by Messrs. Buck & Ryan; it consisted of a small slide rest which could be bolted to the faceplate and enabled the eccentricity of the tool-holder to be adjusted. Primarily intended for boring, it was also adaptable for face milling and similar operations within the scope of a single-point cutter.

Cutters of small diameter are sometimes made with a single cutting edge, and may often be found to work more cleanly and efficiently than ordinary milling cutters. They consist virtually of simple D-bits, ground away in certain cases to provide better front clearance or more efficient rake angle. A plain D-bit, however, works quite well as a rotary cutter for very fine precision milling at high speed, and this is the form of cutter almost universally employed in engraving machines, which may be regarded as a specialised form of vertical profile milling machine.

One very important advantage of the single-point cutter, for occasional work, is the ease of making the bit, and also of re-sharpening it when required.

Principles of Multi-point Cutters

A cutter of this type may be regarded as the equivalent of a number of single-point tools mounted radially in a hub, all being exactly the same in form, rake and clearance angles, and projection radius. Such a cutter is illustrated in Fig. 8, and although this example is used only for the purposes of explanation, it is quite possible to make a successful cutter of th's type, instead of making it from a solid piece of tool steel by cutting it away to form the teeth.

By examining a single tooth of the cutter, the various angles of rake and clearance can be readily understood. Rake angle depends upon the angle of the forward cutting face, relative to the radial line, and in the case of an inserted-tooth cutter, may be influenced either by the angle at which the cutter bit is set in the hub, or by the angle at which it is ground. Front or peripheral clearance is determined by the angle of the outer tip of the cutter to the tangent line. Side rake is produced by grinding the forward face of the cutter obliquely in relation to the axis of the hub, and it should be noted that in a cutter designed to cut on the sides of the teeth, the application of side rake results in producing negative side rake on one side, and positive rake on the other. If a cutter is required to work equally efficiently when cutting on either side, it is usual to stagger alternate teeth and grind the side rake alternately, also, so that it suits the direction of cut taken by each respective tooth.

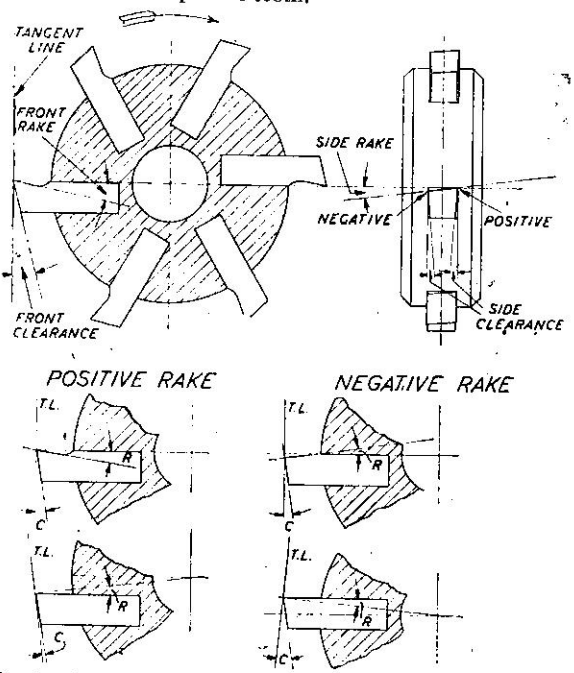


Fig. 8. Inserted-tooth milling cutter, illustrating rake and clearance angles

Within recent years, a great deal of attention has been attracted by the possibilities of "negative rake" milling cutters, but it is pointed out that the real advantages of these only apply when special machines and special tool steels are available.

(To be continued)

*Railway Interlocking Frames

By O. S. NOCK, B.Sc., M.I.Mech.E., M.I.R.S.E.

No. 7—Saxby and Farmer's 1888 duplex apparatus

AFTER the Stevens patent for tappet locking, described in the first instalment of this series, had run out, the rival manufacturers were not long in applying this simplest of locking mechanisms to their own products, and combining it with their especial methods of actuation. Thus Saxby and Farmer Ltd. produced a frame in which the locking tappets were driven by movement of the lever-catch handle, while McKenzie and Holland retained their cam motion, driven direct from the lever, though replacing the oscillating "soldiers" and rocker-locks by a simple locking trough with tappets passing through in the Stevens manner. Other firms, Dutton's, Evans O'Donnell's, and the Railway Signal Company each produced designs—all using tappet locking. In so doing, however, each one in turn managed to include some markedly distinctive feature, or features, and these types of apparatus will in turn be illustrated in this series. In this article I am concerned with one of the earliest, the Saxby and Farmer 1888 type, as consideration of the locking mechanism in this apparatus introduces an important principle in design, which will recur from time to time in the course of these articles.

In the Stevens frame, with the tappets attached direct to the levers, the stroke of the tappets is long, ranging from 8 in. in the lowest position to a maximum of 1 ft. 5 in. At the same time the locking troughs have an extreme width, over the horizontal bars, of only 6 in. Thus a lock notch cut in the tappet passes entirely clear of the locking trough when a lever is pulled from normal to reverse. With the short strokes favoured by the rival firms, such as the 2-in. movement of the McKenzie and Holland cam motion, a lock notch would move across, and might come in line with another horizontal bar, and so cause a false release. The Saxby and Farmer duplex mechanism is designed to avoid this trouble and at the same time retain the advantages of a relatively short tappet stroke. Fig. 1 shows a cross-sectional view of this apparatus, the particular frame illustrated having an eight-channel locking trough. The general construction displays some marked changes from the old "rocker and grid" frame, and a general tendency to draw into line with the then-usual build-up of locking frames. The quadrant plates are carried on two flat bars, 2½ in. by ⅝ in.; cast-iron standards, spaced at regular intervals, are introduced, and although the base girder is reminiscent of the "rocker and grid" frame, this girder is provided with feet resting on a couple of massive timber joists running horizontally throughout the length of the frame. The curious forward tilt of the whole standard will be noted. A study of the

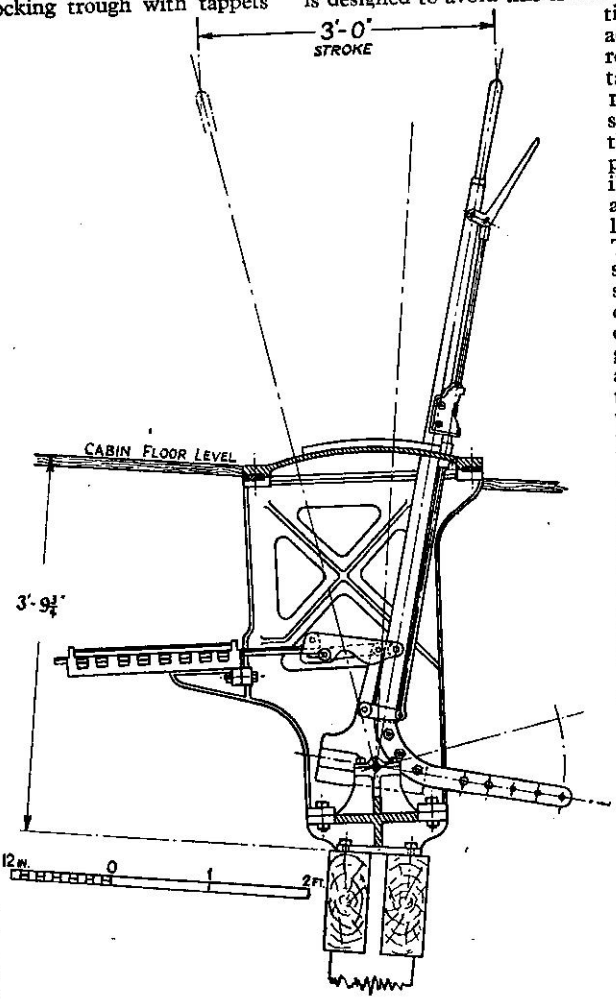


Fig. 1. Cross-section of Saxby 1888 duplex-type locking frame

* *Continued from page 633, Vol. 94, "M.E.," June 27, 1946.*

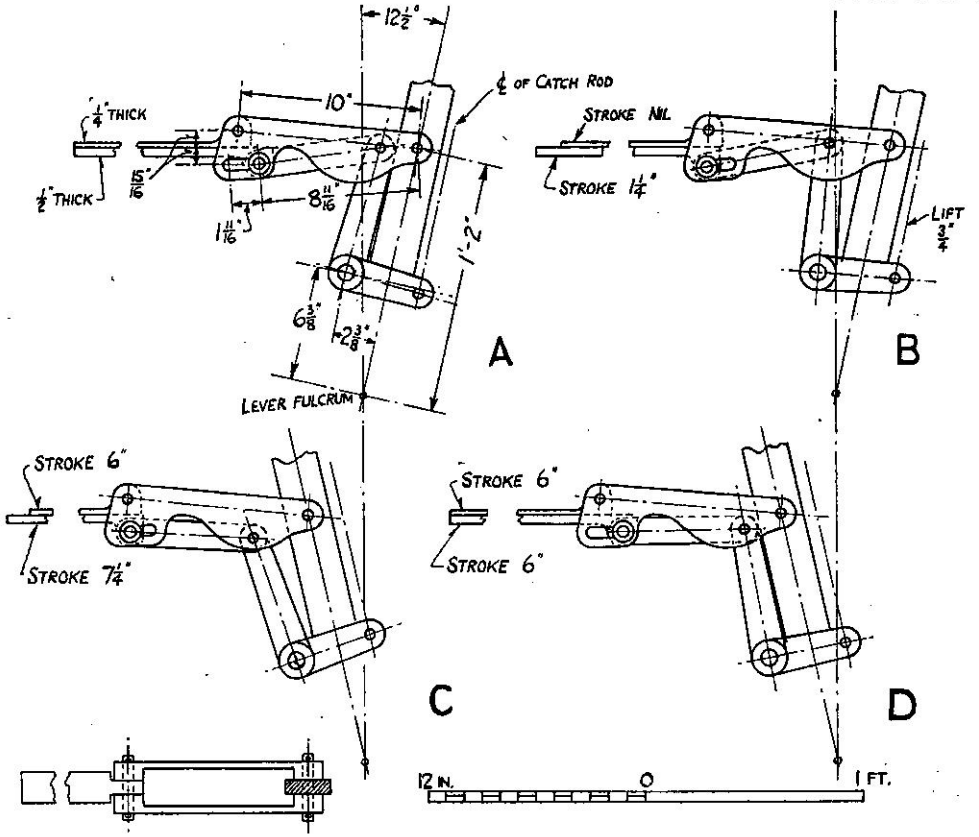


Fig. 2. Arrangement of duplex tappets.

general shape of this standard leads one inevitably to the conclusion that the two horizontal frame bars were originally intended to be on the same level, and the lever working equally on either side of the vertical centre-line; then it would seem that other considerations compelled changes after manufacture was well advanced, and the requisite tilt-forward was arranged by a simple alteration to the base girder. Otherwise there seems no rhyme nor reason for so weirdly-lopsided a standard.

The outstanding feature of this apparatus, from the operational point of view, is, of course, the duplex mechanism, and the working of this is illustrated in Fig. 2. In this diagram (A) is shown the position of the various parts when the lever is in its normal position and the catch is down. There are two tappets, one ½ in. thick worked by the catch-rod, and the other ¼ in. thick worked direct from the lever. The catch-rod is extended downward below the quadrant almost to the lever fulcrum; there it is attached to a bell-crank, itself pivoted on the lever shoe. The raising of the catch lifts the rod ¾ in.; this imparts a stroke of 1¼ in. to the connecting link, the left-hand end of which moves in a slotted hole in the driving bracket. Thus, as shown in diagram (B) the ½-in. tappet is driven out 1¼ in., actuating the locking in the process, while there is no movement by the thin tappet. The lever is then pulled over, see diagram (C) and both tappets are moved 6 in. The

(*Continued on page* 112)

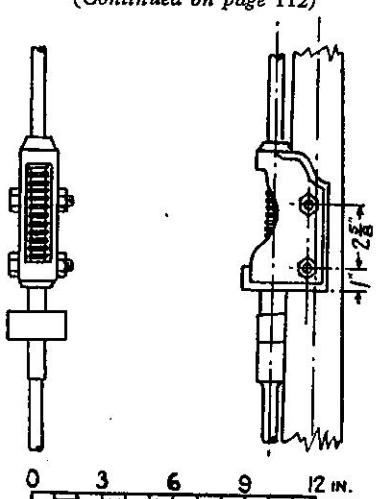


Fig. 3. Spring catch-box

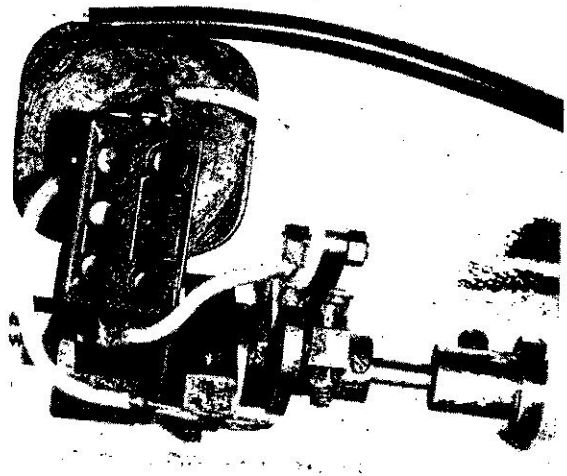
1½-oz. and 3½-oz. magnetos

AFTER making a 15-c.c. "Kiwi" engine to Mr. Westbury's design, from a set of commercial castings and blue-prints, I thought it might be interesting to see how a half-scale model of this engine would perform. As commercial castings were, of course, unobtainable in this size, and finished weight was no criterion, it was decided that fabrication would be a satisfactory means of overcoming this difficulty. The half-scale bore and stroke are half-inch and nine-sixteenth inch respectively, giving a capacity of 1.8 c.c's., the cylinder barrel being made from dural with a pressed-in cast-iron liner. The piston is a cast-iron shell with a domed top, the gudgeon-pin bosses being a separate insert held in place with one 6-B.A. screw through the piston crown. The gudgeon-pin is therefore fully floating but cannot come into contact with the cylinder walls. The piston and cylinder were individually lapped to as fine a working tolerance as possible. Thirty-one separate items, including strengthening fillets and webs, make up the crank-case, which was silver-soldered at one heat. A small amount of extra metal was left on the important faces for machining after silver-soldering to correct any distortion which may have taken place. The crankshaft is built up from $\frac{3}{16}$ in. diameter silver-steel and mild-steel crank-webs silver-soldered into position. A light cut was taken over the main journals to ensure truth of running, the crank-pin being drilled and fitted with a banjo oil-thrower, as in the full-size version. Bronze balance-weights are soldered and screwed to the crank-webs with 12-B.A. cheese-head screws. The connecting-rod is machined from solid duralumin, the little end holding a bronze bush, and the big end running direct on the crank-pin and held together with two 10-B.A. high tensile steel screws.

The cylinder-head is another piece of fabrication and contains eleven separate parts, again silver-soldered at one heat. The internal shape of the head is hemispherical and the valve seats and guides are made in one piece, to ensure concentricity, and pinned into position through the face of the inlet and exhaust flanges. They are therefore readily renewable should excessive wear take place. The valves are made from the stem of a commercial motor-car valve, the heads being ¼ in. diameter and the stems 5/64 in. diameter, with the usual groove to hold the retaining cotters. The valves are held on their seats by two double "safety-pin" valve springs made from 21 s.w.g. piano wire, as the more usual helical spring was found to restrict the maximum revs. due to insufficient strength. The rocker box is made from brass sheet, bent up, and the necessary bosses are silver-soldered into position to simulate a casting. Valve rockers were machined from solid mild-steel and, along with all other mild-steel components, were case-hardened. The push-rods are concealed by a telescopic brass tube, and an aluminium rocker-cover gives a finished appearance to the engine. The carburettor is again built up from brass and is fitted with an adjustable taper needle jet feeding through an auxiliary venturi into the main choke tube. The float chamber contains the usual needle valve lifted by a hollow metal float weighing ½ gram. Lubrication is provided

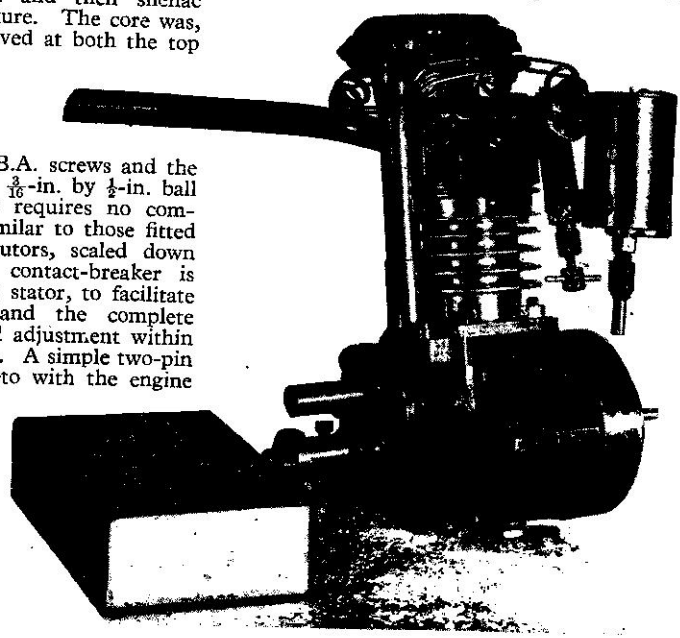
from a small tank supplying direct into the front main bearing, the necessary suction being given by a non-return valve in the camshaft housing, the oil-flow being regulated by a small tap in the suction line. The piston, on its up-stroke, therefore creates a partial vacuum in the crankcase, this suction being sufficient to inspire the necessary oil supply, and upon the down-stroke of the piston the valve opens and allows the pressure to be expelled to the atmosphere. This method of lubrication, incidentally, has proved quite satisfactory.

Having constructed the engine, which ran very satisfactorily on coil ignition, it was thought desirable to turn some attention to the manufacture of a small magneto in keeping with the overall size of the engine unit. With this in mind, a start was made on the first of the two magnetos, using a small "alni" magnet $\frac{5}{8}$ in. diameter and $\frac{3}{8}$ in. long, purchased from an advertiser in this journal. Using four pole-pieces with a $\frac{1}{16}$-in. air gap between each and the magnet, the smallest diameter of rotor possible was $\frac{7}{8}$ in. diameter, and the stator core was based on this size. The core was cut out of 0.015-in. mu-metal strip and was built up to a thickness of $\frac{3}{8}$ in., leaving a winding space measuring $\frac{9}{16}$ in. by $\frac{7}{16}$ in. The primary winding consisted of 220 turns of 31 s.w.g. enamelled wire wound over a piece of 0.005-in. leatheroid placed directly on the core. The secondary winding consisted of approximately 9,000 turns of 46 s.w.g. enamelled wire, paper interleaved each layer, the whole being boiled in special impregnating paraffin wax and then shellac varnished to keep out moisture. The core was, of course, split and interleaved at both the top corners so that the top piece of the core was readily removable to facilitate winding. The core is held to the duralumin back-plate by means of 10-B.A. screws and the back-plate itself carries two $\frac{3}{16}$-in. by $\frac{1}{2}$-in. ball races. The contact-breaker requires no comment, as it was basically similar to those fitted to Lucas motor-car distributors, scaled down suitably, of course. The contact-breaker is adjustable in relation to the stator, to facilitate maximum spark setting, and the complete magneto is capable of radial adjustment within the bakelite mounting bearer. A simple two-pin coupling connects the magneto with the engine crankshaft. The total weight of this magneto is $3\frac{1}{2}$ ozs., including a 0.0001 microfarad condenser. Easy starting was a feature of this magneto being accomplished as easily as with coil and battery, and no misfiring was experienced over the whole speed range up to a maximum of something in excess of 10,000 r.p.m.

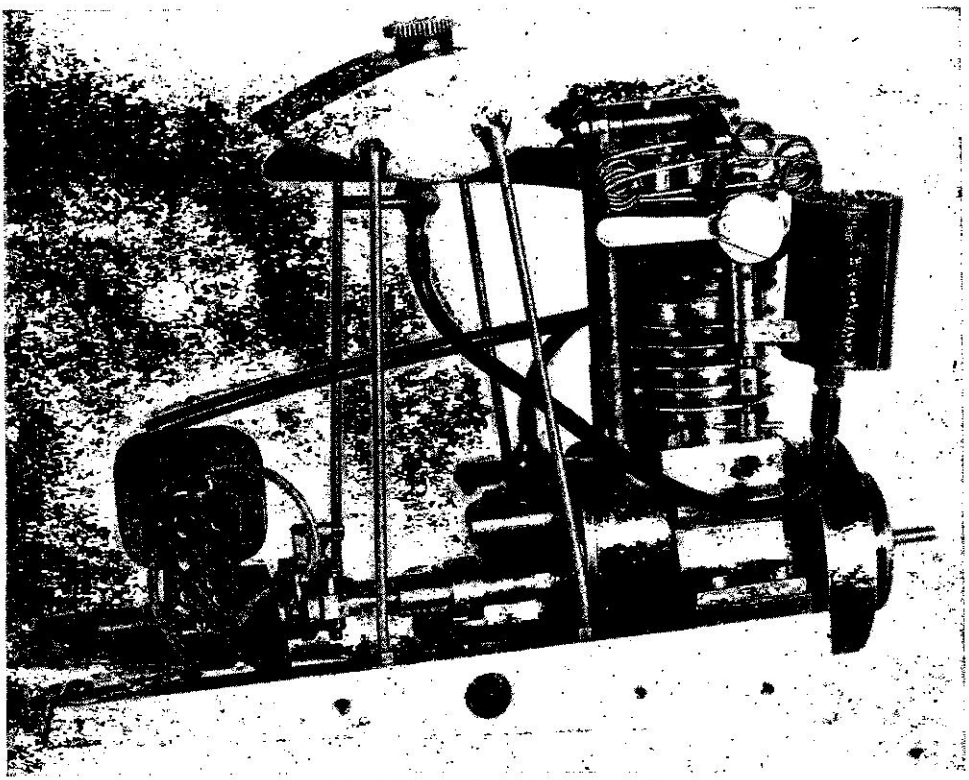


Second magneto weighing $1\frac{1}{2}$ oz.

When viewing the complete outfit, it was felt that the magneto was still somewhat out of proportion in comparison with the engine, and another magneto was made, similar in appearance to the first but using a $\frac{3}{8}$ in. square by $\frac{1}{4}$ in. long "Ticonal" magnet which gave a rotor diameter of $\frac{5}{8}$ in. The core was again constructed from 0.015 in. mu-metal and is split at one corner only, being fastened to the duralumin back-plate by 10-B.A. steel screws. As space was somewhat limited, a plain journal bearing is fitted which, to



1.8-c.c. overhead valve engine



Complete power unit with 1½-oz. magneto

date, has given no trouble. The primary coil is of 230 turns of 36 s.w.g. enamelled wire, paper interleaved, and the secondary consists of 6,000 turns of 48 s.w.g., paper interleaved each layer. To assist insulation the secondary is wound separately to a bobbin made from solid "Tufnol," and a slip of mica is inserted between the surface of the coil and the rotor. A 0.0001 microfarad condenser is again used, it being observed that a larger capacity made little or no difference to general performance. The total weight of the second magneto is slightly under 1½ ozs. Starting, with this magneto, is not quite as easy, the mixture setting being a little more critical due to the shortness of spark available. Maximum engine speed was again in excess of 10,000 r.p.m., no misfiring being experienced over the whole speed range. The total weight of the power unit, including engine, magneto, petrol and oil tanks and engine bearers, is one pound five ounces, the excessive weight of the engine being due to fabrication from brass. It will be observed that the magnetos are both run at full engine speed to assist starting, this giving rise to an unused spark towards the end of the exhaust stroke.

While both these magnetos are quite satisfactory for an engine of these dimensions, it is not claimed that they would operate an engine of very much greater size, having a better compression efficiency, but it would seem that there is room for experiment directed towards producing an even smaller magneto.

Railway Interlocking Frames

(*Continued from page* 109)

thick one has now travelled a total of 7¼ in., but the release of the catch handle restores the bell-crank to its position against the lever, retracts the thick tappet 1¼ in. and so brings both tappets into line again at the end of the stroke. The locking will not, of course, be released until the notches in both thick and thin tappets line up, so that there is no chance of a false release occurring should the lever be left, inadvertently, in some position short of full reverse. The pitch of the locking channels in the trough is 2¼ in. so that although notches in the tappets may not pass clear of the trough they would not, in the full reverse position, foul any other locking. The spring loading of the catch-rod is shown in Fig. 3.

This type of locking apparatus was, with several others, used extensively on the Great Northern Railway, but it is in the Dominions that it has been most widely used. Even today it is the standard type of mechanical locking frame on the South African Railways, and in India too, particularly on the Great Indian Peninsular Railway, many examples are still in service.

(*To be continued*)

Lathe Improvements

By Niall MacNeill

(Based on a lecture delivered to the Dublin S.M.E.E.)

NOTWITHSTANDING all that has been written on the theme of improvement of the amateur's small lathe, I consider that scope remains for further study and discussion of the subject. I venture, therefore, to offer a series of suggestions, consisting on the one hand of a programme of simple improvements applicable by the lathe-owner, and on the other, of some further proposals of inexpensive modifications and accessories which could be applied by manufacturers. The two are not segregated, since several of the suggestions come under both headings.

To suggest improvements inevitably implies criticism of existing equipment, but I wish to emphasise that what follows is not aimed especially at, still less a mere criticism of, the "Zyto" 3⅜-in. lathe by photographs of which the subject is illustrated. So far from considering that lathe particularly deserving of criticism, I believe that its makers had a good deal of justification for the claim, made when it was introduced to the market a few years before the war, that it was ahead of others in the same size and price category (usual disclaimer). Indeed it incorporates, as sold, several good features which, in other cases, could be included in the programme of applicable improvements, for example: (1) long cross slide, (2) headstock and bed separate castings, (3) tumbler reverse gear. Moreover, discussions with owners of a fairly representative collection of other makes, confirm that the improvements proposed are widely applicable.

I have every admiration for the "knights of the treadle," but consider that wherever possible the application of a power drive, preferably by means of an electric motor, should be part of the "plan."

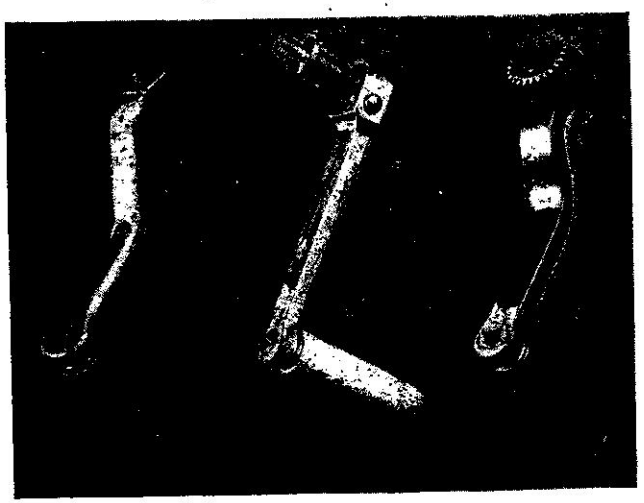


Fig. 1. Lathe-driving handles

Driving the Lathe by Hand

There are, however, a certain few types of work in which some means of driving the lathe by hand, as against either power or treadle, is advantageous. "L.B.S.C." has referred on several occasions to the convenience of this method in dealing with outsize jobs, such as turning the treads and flanges of driving wheels of "live steam" locomotives. Another case is screwcutting by means of taps and dies held in tailstock holders. For this, "pull the belt by hand" is sometimes prescribed as the appropriate method. Except, however, where only a turn or two of the mandrel is required, this is an objectionably jerky and discontinuous method of driving. It may also tend to inculcate subconsciously the bad habit of putting one's hands near belts, shafting, etc., when it is not necessary and may be dangerous to do so.

Obviously the proper appliance is some form of handle. Fig. 1 shows three types, of which *A* and *B* are of quite simple construction, being bicycle pedal cranks adapted to the purpose. In *A* the boss is made a replica of the bore of the change wheels. *B* utilises one end of a bicycle crank axle shouldered and screw-cut $\frac{7}{16}$-in. B.S.F., and is applied by tapping the outer end of the ⅜-in. hollow mandrel to receive it. Its peculiar advantage is that lathe screwcutting, i.e. using the change wheels, as distinct from the application of taps and dies by tailstock holders, can be done by its aid. This is a very convenient means of doing short and up-to-shoulder screwcutting jobs. The ease of stopping dead and the benefit of being able to feel the cut are pronounced advantages.

C is what might be described as a "safety" handle, applicable to tumbler reverse lathes, but unadaptable to lathe screwcutting. A "superannuated" motor car starting handle provided the material for the shank in this case, the large-diameter boss lending itself to the design. This type of handle may be found particularly convenient in work in which power and handle drives repeatedly alternate, such as repetition-manufacture of a number of screws using tailstock or capstan die-holder. It might, per-

haps, be regarded as eliminating the need of making slip-holders for the use of taps and dies in a capstan attachment. The handle is substituted for the driven element of the tumbler gear. A pinion (made of steel in preference to cast iron and being a replica of the driven pinion of the cluster gear) is permanently fitted to the boss. This is drilled to fit snugly on the cluster-gear pivot-pin. Fig. 2 shows it mounted on the lathe. When not in use it is held out of engagement by a light spring, the drilled hole in the pinion being counter-bored to a sufficient diameter and depth to accommodate the spring fully when it is compressed by engaging the handle.

If a handle with shallower boss than shown in Fig. 2 is used, it may be just possible to adapt it to the existing pivot-pin of the tumbler gear, instead of substituting—as was done in the case illustrated—a new and slightly longer pin. An objection to the latter procedure is that it involves the addition of a distance-piece (thick washer) to the equipment required when the tumbler gear is serving its normal purpose.

In the other instances, i.e. those in which the handle does not automatically disengage, it will be most important to beware against carelessly switching on the power while the handle is in position, else a serious injury to hand, wrist or forearm might result.

Dividing

One of the earliest felt needs in many cases will be some means of dividing. In some lathes—notably the "Exe"—cone pulley or back gear faces are drilled as division plates. Even where such provision does not exist, the simplest and withal a reasonably accurate method, is the use of the lathe mandrel gears as dividing heads. The lathe may be a back-geared one with tumbler reverse in which two gear wheels on the mandrel are available for use, namely the large back gear pinion and the driver of the reversing train. In the absence of tumbler reverse, the large back gear wheel (if a back gear is fitted) and (in most screwcutting lathes) all of the change wheels may be used. Reliance should not, however, be placed on the key or pin by which a change wheel is ordinarily driven. Some means of locking the wheel to the mandrel which will eliminate any suggestion of shake or backlash, if not there already, must be provided.

Before going on to make further reference to the various available methods, I offer the following suggestions, whereby—in the more conventionally designed of these small lathes—the convenience in use as division heads of the gear wheels, and their versatility as such, might be augmented.

A simple detent (indexing appliance) could be devised, and offered by manufacturers as an extra, suitable for mounting on either limb of the headstock. I envisage that the housing for this might be a small casting somewhat similar in shape to a travelling steady rest, to be substituted for and fixed by the same means as the back gear guards. The base of this casting could be of such design as would provide positive fixing—particularly eliminate any risk of displacement about the axis of the fixing screw. If the sleeve carrying the detent proper were made adjustable for height and capable of being locked in any such adjustment, the device would be adaptable to any size of pinion from the large back gear wheel to the smallest change wheel. Such equipment would suffice, both as to range and accuracy, to meet the needs of many and a ready market for this extra should be assured.

An 80-tooth wheel, as used in the back-gearing of some of these lathes, when serving by itself alone as a dividing head, leaves a good deal to be desired. The fact that this number is not evenly divisible by 3 seriously curtails its range. Moreover, if the idea of using both back gear and reversing driver—as above suggested—is pursued, it will be seen that whatever advantage 80 may have in being divisible by 5 is largely offset if 25-tooth pinions are used in the reversing train. Matters would be distinctly improved by employing 24-tooth pinions in these positions. This would involve no difficulty in the design, manufacture, or use of the machine, but would give us 24, 12, 6 and 3 divisions in addition to those obtainable from the 80 wheel, as against which gain the only number lost would be 25. The general usefulness of these additions to the range, and notably of 6 for hexagons, needs no emphasis. I think, however, that there is scope for going a lot farther.

A review of back-gearing possibilities, having regard to suitable pitch and pitch diameters, would seem to indicate that in lathes of this class we may take 66/22 (15 Diametral Pitch) and 80/30 (20 D.P.) as representing at least approximately the limits. The 66/22 (15 D.P.) arrangement used in the 3½-in. Drummond may be ruled out as unsuitable to smaller headstocks, and because the pitch is rather coarse: there would also appear to be some advantage, with respect to range of speeds, in a 7 to 1—as against 6 to 1—ratio. At the other extreme, 20 D.P. may be regarded as undesirably fine, especially with reference to worm-dividing possibilities.

Optimum characteristics will subsist if the ordinary requirements of back-gearing can be combined with a wide-range capacity in both direct and worm dividing. I suggest that this would be the case if 72 and 27-tooth wheels (18 D.P.) were used for the back gear, leaving 25 as the driver of the tumbler reverse, but here also using 18 Diametral Pitch. This gives, approximately, the popular ratio of 7 to 1, while pitch circle diameters in the back gear and mandrel-to-layshaft spacing also remain identical with the 80/30 (20 D.P.) arrangement.

I would even go so far as to suggest that a worm-dividing head could be devised which, like the detent-housing already proposed, would be adaptable to mounting on either limb of the headstock, giving a choice of "worm-wheels" and therefore wide range with respect to a given equipment of indexing plates. In obtaining the simpler divisions (smaller numbers) the use of a small worm wheel much reduces the amount of turning and counting to be done and a 25-tooth worm wheel presents a marked advantage in dividing to some of the higher *odd* multiples of 5, e.g. 125 (an important number). At any rate the combined use of 25-tooth and 72-tooth wheels for direct dividing, by employment of back gear and tumbler reverser, gives a wider and more useful range than is otherwise attainable by these

means, viz.: 72, 36, 25, 24, 18, 12, 9, 8, 6, 5, 4, 3 and 2.

The problem assumes a somewhat different complexion in lathes not having tumbler reverse, and in which the change wheels are mandrel-mounted. Here, there is something to be said for retaining the same diametral pitch in back gear and change wheels, and assuming this to be 20 the 80/30 back-gearing should—it seems—be retained. In this case, however, the number of teeth in the large back gear pinion is not—from the point of view of dividing—so important, since in compensation for any lack of versatility therein we have the whole range of change wheels to draw upon. In this case also, however, I visualise the possibility of using an interchangeable detent for direct dividing if not indeed interchangeable worm-head for worm dividing.

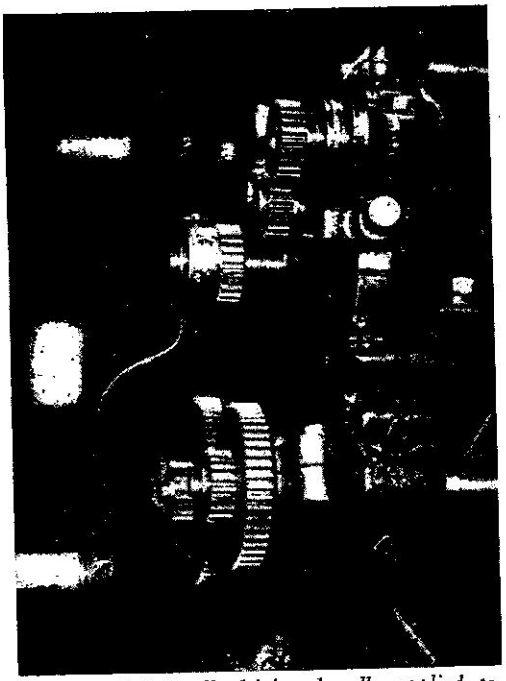


Fig. 2. "Safety" driving handle applied to lathe

These, however, are only tentative proposals. Others may see objections to them which have not occurred to me, in which case our worthy Editor may perhaps be prepared to give further space to the discussion of the subject.

Of the available methods, direct dividing by change wheels in lathes to which this process is suited, is no doubt the simplest method and, properly applied, can give satisfactory results for many purposes.

Not an unusual windfall or "heirloom" among members of the fraternity is an old division plate of good quality. Beware, however, of the imposing looking article which turns out, on close inspection, to be inaccurately divided. Also, new plates of good manufacture can—when supplies are normal—be had at reasonable prices from advertisers in THE MODEL ENGINEER. In the third place they can be made—with varying degrees of precision according to choice, skill and equipment—by various methods which have been described in this journal.

Some form of mandrel extension-piece will normally be required. Assuming a hollow mandrel (in the absence of which the problem presents serious difficulties unless the mandrel projects far enough to need no extension) the best form of this device is that which is mounted by means of an internally tapered split spigot and expansion bolt. If, however, the hollow mandrel has been tapped to accommodate a driving handle of the kind shown by Fig. 1 (b), a mandrel extension-piece having a screwed nose (Fig. 3) can conveniently be used.

To make an extension-piece of the latter kind, the screw-in nose and shoulder are machined first and the rest of the machining done with the work mounted in an internally screwed chucking piece. It is also necessary to ensure that the face of the outer end of the mandrel is true and, if not, to skim it up by the use of some sort of jury-rigged tool holder. Careful use of a hand tool, suitably supported, will serve. Normally this face should require no such attention. It will be necessary to ensure that the extension-piece, when in use, is locked to the mandrel, wherefore the plain part (body) of the extension is made a shade shorter than the combined depth of the division plate and its boss. The lock-nut, for which the outer end of the extension is screwed, then serves to secure the division plate and to lock the whole lot solid with the mandrel.

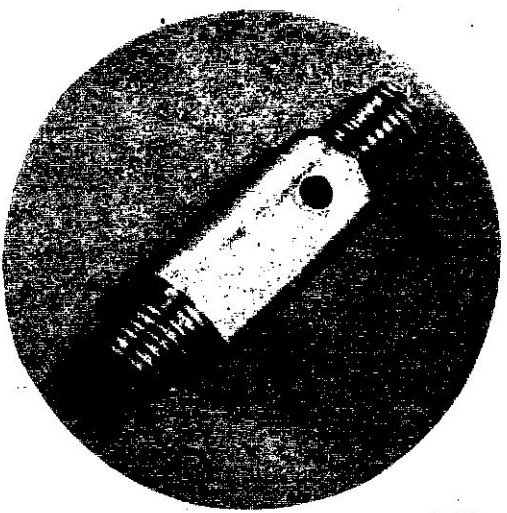
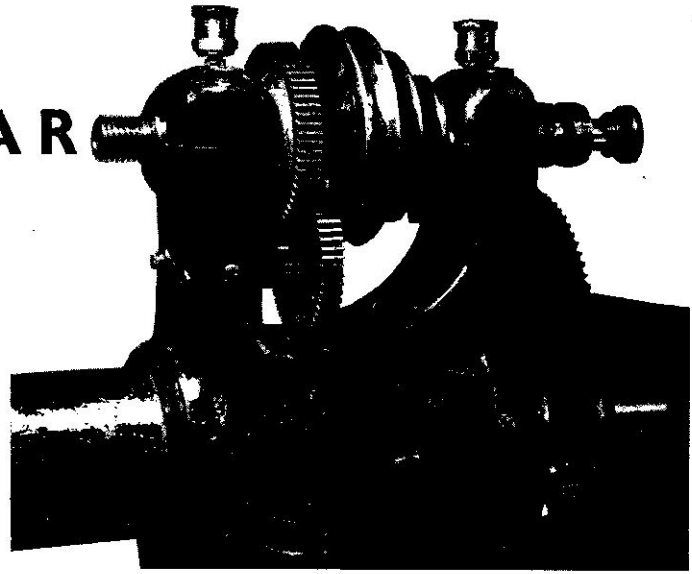


Fig. 3. Mandrel extension-piece to carry division plate

(To be continued)

BACK-GEAR

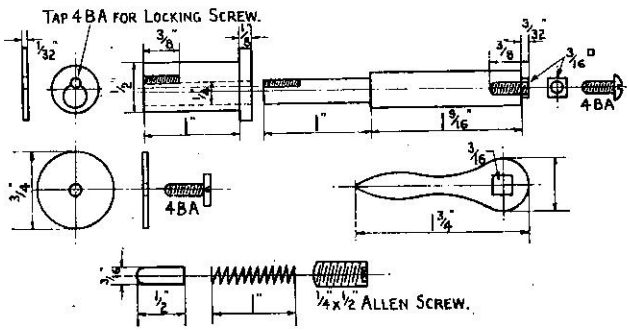
Fitting a useful accessory to a "Drummond" round-bed lathe



By A. Harrison

AFTER spending quite a lot of time and thought on how to fit a back-gear to my "round-bed," I evolved this comparatively simple and cheap method from easily-obtained parts; the cost being only 32s. 9d., and giving a reduction of just over 5 to 1. The 3-step V pulley and gears were obtained through a local dealer and are standard "Myford" lathe fittings. The pulley, which has a 30-tooth pinion pinned to it and also the large gear of 65 teeth are already bored 1 in., and fit the Drummond mandrel beautifully. The loose gears are composed of one 55-tooth gear and a 20-toothed pinion fastened together, the only alteration necessary being to reduce the boss on the pulley. This was mounted in the 4-jaw and turned down till the pulley measured $2\frac{1}{16}$ in. overall.

A half-inch channel was next chipped and filed in the lathe head casting, $\frac{1}{8}$-in. deep to allow the loose gear to disengage properly. A $\frac{1}{8}$-in. hole was then drilled through the front of the lathe head casting in the position shown by mounting a hand-brace on the saddle and packing up for parallel height. This hole was then opened up to just under $\frac{3}{8}$ in. A temporary centre was next clamped to the saddle and adjusted to the centre height of the drilled hole, and a $\frac{3}{8}$-in. parallel reamer inserted between this centre and casting; and by slowly feeding the saddle forward and, at the same time, turning the reamer with the aid of a spanner on the squared end, a really true hob was obtained parallel with the lathe bed.



Details of back-gear components

A $\frac{3}{16}$-in. hole was next drilled through the head casting at right-angles to the $\frac{3}{8}$-in. hole and tapped $\frac{1}{4}$-in. Whitworth for $\frac{1}{8}$ in., this being to take the spring-locating plunger. The plunger was made from $\frac{1}{8}$-in. of $\frac{3}{16}$-in. silver-steel, one end being reduced to fit the dimples later drilled in the eccentric spindle.

The eccentric and spindle were both turned from silver-steel to the dimensions given, and a $\frac{1}{4}$-in. hole drilled $\frac{1}{16}$ in. off centre, the spindle being made a good push-fit to this hole.

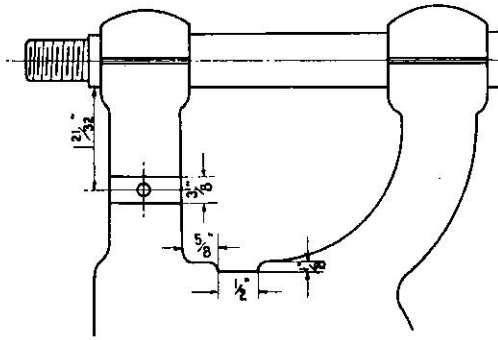
They were then centre-popped on the centre-line at the side of the $\frac{1}{2}$-in. spindle end, and a hole drilled and tapped 4-B.A. $\frac{3}{8}$ in. deep to take the locking-screw with washer.

A $\frac{3}{16}$-in. square was next filed on the other end of the spindle which was also centred, drilled and tapped 4-B.A. This was to take the operating lever which was made from a piece of $\frac{1}{8}$-in. cast steel.

The large gear (65 teeth) and V-pulley, not forgetting the original fibre thrust-washer, were then fitted in position on the lathe mandrel, the eccentric fitted to the loose gear and held in position while the spindle was pressed into position through the head casting and the washer and locking-screw fitted.

The operating-lever was then fitted and raised until the gears engaged nicely without binding,

and held in this position while a $\frac{5}{16}$-in. drill was fed through the hole previously made in the back of head casting, to make a dimple about $\frac{1}{16}$-in. deep in the eccentric spindle; this locates the gears in the engaged position. This drill was again fed through with the lever in the downward position and the gears



just out of engagement.

All that now remained was to drill a $\frac{5}{16}$-in. hole through the centre of the pulley and tap $\frac{1}{4}$-in. Whitworth for a $\frac{1}{2}$-in. Allen locking-screw.

A dimple was then drilled in the mandrel to take this screw, and another to take the fixing-screw of the large fixed gear.

A LEAD-SCREW ENGAGER

By C. Harrison

I HAVE recently purchased a new Drummond-Myford 3½-in. lathe and consider it is very easy to operate and extremely accurate.

I was, however, not quite at home with the method of engaging the lead-screw and decided I must do something about it. So, after thinking, I evolved the following :—

First of all, I removed the knob provided to operate the lead-screw, putting the small spring-washer and screw on one side for future use.

Now just above this knob, on the apron, in front of the slide-rest, is a $\frac{3}{8}$-in. bolt with hexagon head.

This was also removed, and a special bolt made, with a round head, $\frac{1}{2}$ in. diameter, 1 in. long. A $\frac{1}{4}$-in. hole was drilled through this near the end, to tighten it up, also for another purpose (described later).

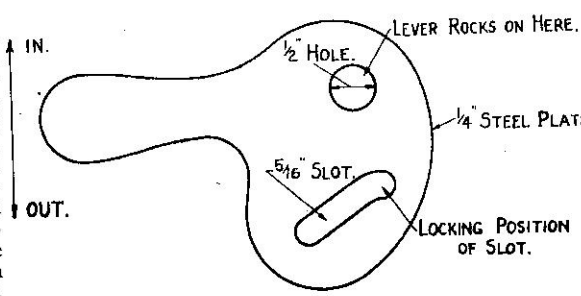
Now, the idea was to make and fit a plate with a handle to operate the lead-screw, as per sketch. Before I fixed the special bolt just mentioned, I got a piece of cardboard, roughly cut to shape, and using the original bolt, punched a $\frac{3}{8}$-in. hole near the top of the cardboard template. Keeping the handle down on the left side of template and the lead-screw disengaged, I pressed the template hard against the pin which previously had the knob on it. Now, raising the handle to working position, and engaging lead-screw, I again pressed the template against the pin end. This pin is $\frac{5}{16}$ in. diameter.

I now had two distinct marks on my template showing the engaged and disengaged positions of lead-screw. A $\frac{5}{16}$-in. hole was punched exactly on each of these marks and the two holes joined together with a slot $\frac{5}{16}$ in. wide. By raising and lowering the template, which could rock on the $\frac{5}{16}$-in. bolt, I carefully engaged and disengaged the lead-screw.

The pin which connects to the lever inside the slide-rest, for connecting and disconnecting the lead-screw nut, slides up and down the slot in my plate lever. I next cut a lever out of sheet-brass and, after a bit of filing and coaxing, it worked well. I ran the lathe and tried it traversing, and all was well.

I first fixed a loose handle on my brass template and soldered it, moving it until I got the best operating position. I also carried the slot forward in a straight line in full engagement of nut to lock it in working position, as shown. I made a permanent plate lever in $\frac{1}{4}$-in. mild-steel, complete with handle, all in one piece.

The lever is held firmly in position against the front of apron with two coiled springs, one at the top on the $\frac{1}{2}$-in. pin on which it rocks, and the other on the $\frac{5}{16}$-in. pin which works in the slot. The original spring, washer and screw were used here. The spring at the top was kept in position with a flat washer, and then a short piece of $\frac{1}{4}$-in. round steel fixed in the hole previously drilled, as described earlier. This arrangement works splendidly, has never given the slightest trouble, and is delightful to use.



5/16" PIN SLIDES UP AND DOWN SLOT.

"L.B.S.C."

BAKER VALVE-GEAR FOR "HIELAN' LASSIE"

THE arrangement of the gear components in the frames is slightly different from the Baker gear assemblies hitherto described, as the head-room is limited by the running-board; and in order to keep the reach-rod below the running-board, as in the Walschaerts gear, the reversing connection is made direct to the stay-bar between the reverse-yokes, instead of having a separate connection above the bar. I worked this wheeze on "Tugboat Annie's" gear for exactly the same reason, and it is perfectly satisfactory. Otherwise, the gear is pretty much the same as described, as applicable to any normal type of engine, about a year or more ago. The dimensions and pin centres of the rods and levers are exactly proportionate to the full-size gear, as given in the manufacturing company's drawings; so there is no question about the accuracy of the various parts, and the steam distribution will be O.K. A glance at the accompanying illustrations will soon convince any doubting beginner, that the Baker parts are far easier to make and erect than any arrangement embodying slotted curved links.

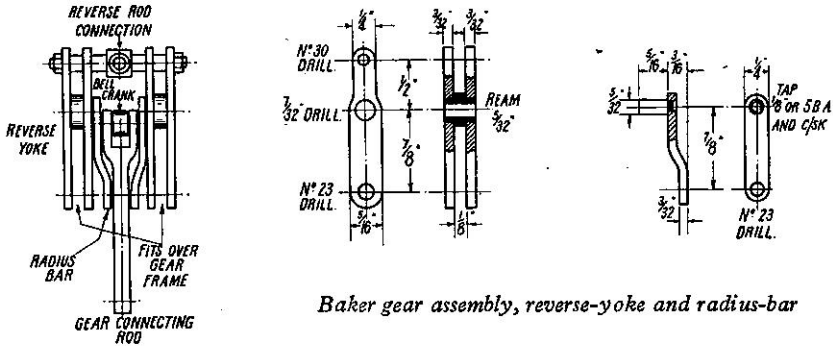
Reverse-Yokes

The full-sized Baker gears originally had single reverse yokes on the inside of the gear frame; and on the first Baker-fitted engine in this country, "Fayette," which I built twenty years ago, I used the single yokes. Soon after that, the double yoke was introduced, on account of breakages occurring on full-sized Baker-fitted engines in the U.S.A., where they haul *really* heavy loads; and naturally, your humble servant wasn't going to be left out in the cold, wherever any improvements were concerned. Apart from the extra strength of the double yoke, there is another great advantage, viz., that the width of each radius bar bearing is also doubled, thereby prolonging the life of the gear, and retaining its accuracy. Drop stampings and castings are used for the component parts of the full-sized gears; but all parts of the small ones are easily made from steel strip, saving a lot of trouble. The minimum of detailed instruction is needed, all dimensions being given on the drawings; and I guess that by this time, everybody who follows these notes knows how to use a file, drill holes accurately, and do a bit of plain turning!

Whilst on the job of making components, you might as well make both sets together, as they are the same on both sides of the locomotive; so cut eight 1¼-in. lengths of $\frac{5}{16}$-in. by 3/32-in. steel strip for the reverse-yokes, mark one out, drill it, and use it as a jig to drill the rest. Use a Wilmot filing jig, or button, to guide the file when rounding off the ends. Turn the bushes from a bit of $\frac{5}{16}$-in. bronze rod held in the three-jaw; face, centre, drill No. 23 for about ½ in. depth, turn ⅛ in. of the end to a squeeze fit in the 7/32-in. hole in the yoke-plate, part off at ⅜ in. from the end, reverse in chuck, and turn down the other end for ⅛ in. length to a squeeze fit as before, leaving a full ⅛ in. of full-size between shoulders. Squeeze a yoke-plate on to each spigot, putting a bit of rod, or a drill shank, through the top and bottom holes, to keep the lot in line whilst applying the "Sunny Jim." File off the spigots flush with the yoke at each side; then very carefully poke a 5/32-in. parallel reamer through each bush.

Radius-Bars

These can be filed up from 3/32-in. by ¼-in. steel strip. You can bend two at once, by adopting the wheeze I gave for cross-head arms, and sawing apart afterwards. Don't forget the bars want to measure ⅞ in. between the centres of trunnion-pin and bottom hole, *after bending*. The trunnion-pin is made from a bit of 5/32-in. silver-steel held in three-jaw. Turn a pip on the end ⅛ in. long and ⅛ in. diameter, screwing it ⅛ in. or 5-B.A.; then screw it into the end of the bar, hammer the end into the countersink, and file flush. That will prevent the trunnions ever coming loose in the bars.



Baker gear assembly, reverse-yoke and radius-bar

Gear Connecting-rod

This is nicknamed the "sickle" on account of its shape, and can either be made from ⅜-in. by ¼-in. steel rod, and bent to shape, or it may be

cut from the solid, just as preferred. I've never had any trouble in getting a true bend; but some followers of our old friend Inspector Meticulous would rather mark out the whole doings on a hunk of steel, and carve it to finished outline, and if you like to take the trouble, well, it's your pigeon! Whichever way you do the job, note the offset at the bottom. Benders who are slotting the forks on the lathe, as described for coupling rods and so on, should use a bit of steel long enough for both rods, which is easier to clamp under the slide-rest tool holder. After forming the fork in one end, reverse the metal and do the other; then mill, plane or file either side until the rod is correct thickness. It can then be sawn apart, and each half drilled and bent to shape as shown.

Bell-Crank

A bit of $\frac{3}{16}$-in. steel plate about $1\frac{5}{8}$ in. by $1\frac{1}{4}$ in. is needed for each bell crank. Here is a marking-out tip for beginners; draw two lines $\frac{1}{16}$ in. apart near one side of the plate, dot the site of the bush hole on one, at the top, and the hole for the valve-rod pin on the other, at the bottom, $1\frac{1}{8}$ in. below the top one. Set your divider points $\frac{13}{16}$ in. apart, and strike an arc from the upper hole; then alter them to $1\frac{1}{4}$ in. apart, and strike another arc from the bottom hole, cutting the first one. At the "level crossing," make your dot to locate hole No. 3. The useful bit of serrated wire known as an "Abrafile" will make short work of cutting out the superfluous metal between the two arms of the bell crank. Drill the two holes in the extremities No. 23, and ream 5/32 in.; the hole in the knee is drilled 15/64 in. or letter "C," and reamed $\frac{1}{4}$ in. The bush is simply a bit of 5/32-in. round bronze $\frac{3}{4}$ in. long, chucked truly in three-jaw, centred, drilled No. 23 and reamed 5/32 in., squeeze it into the hole in the knee of the bell crank, and silver-solder it in position for the sake of "safety-first."

For a long-wearing and trouble-free gear, all the holes that have pins working in them—the reamed ones—should be case-hardened in the same way as described for parts of the Walschaerts gear. The gears on the full-sized engines are furnished with easily-renewable bushes; the holes in the small edition could also be bronze-bushed, the only disadvantage being that you would either have to use smaller pins, or else make the ends of the various parts of larger radius, so as to have enough metal around the outside of the bush, to provide for requisite strength. Not much sense in bushing, if the housing splits and the bush drops out when the engine is doing a bit of record-breaking, either for speed, haulage, or both!

How to Erect the Gears

Cut off two pieces of 5/32-in. silver-steel each $1\frac{7}{16}$ in. long, for the stay bars for the reverse yoke assemblies. Chuck each in three-jaw, turn down $\frac{7}{16}$ in. of each end to $\frac{1}{8}$ in. diameter, and screw $\frac{1}{8}$ in. or 5-B.A. Each assembly needs four distance-pieces or spacers; two are $\frac{7}{16}$ in. diameter, $\frac{1}{8}$ in. long, and drilled No. 30; they go between the two plates forming each side of the reverse-yoke. The other two may be 7/32 in. diameter, 5/32 in. long, and drilled No. 21, and are used to keep the reverse-rod connection in the middle of the bar; see assembly sketch. Any metal will do, but steel looks best. The connection for the reverse-rod looks like a fork which some absent-minded locomotive builder forgot to slot. It is simply a small piece of $\frac{1}{4}$-in. square steel rod, cross-drilled No. 21 (5/32 in. clearing) and rounded-off at one end; the other is turned circular, and drilled and tapped to take a $\frac{1}{8}$-in. rod; see small detail illustration. The latter job is easily done in the four-jaw.

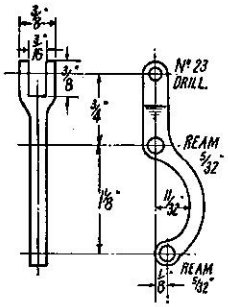
To assemble, proceed as follows:—Put the shorter arm of the bell-crank between the jaws of the fork on the gear connecting-rod, concave sides facing, squeeze a piece of 5/32-in. silver-steel through the lot, and file flush each side of the fork. Put a radius-bar each side of the gear connecting-rod, bottom holes level with centre hole in the "sickle"; squeeze a 5/32-in. silver-steel pin through the lot as before, and file off flush. Put a $\frac{1}{8}$-in. spacer between the two plates at the top of one of the reverse-yokes; poke one end of the stay-bar through, and secure with a nut. Put a 5/32-in. spacer on the bar, then the reverse-rod connection, and then another spacer; then—mind the bits don't fall off whilst you do this!—enter one of the trunnion pins on the radius bar, into the bush in the reverse yoke. Next, put another $\frac{1}{8}$-in. spacer between the tops of the plates on reverse-yoke No. 2, and place it in position, the other radius-bar trunnion entering the bush, and the end of the stay-bar going through the holes and spacer at the top. Put on a nut to keep the bits together, and the "movies" are complete.

It only remains to erect the gear in the frame. Take the bell crank spindle out of the frame, and drop in the whole daffy of rods from the top, so that the bell-crank bush lines up with the holes where the spindle goes through, and the bottom holes in the reverse yoke line up with the bottom holes in the gear-frame. Replace the bell crank spindle, poking it, screwed end first, through the long bush, and put a nut on where it projects beyond the gear frame. Squeeze short 5/32-in. silver-steel pins through the bottom holes in the reverse yokes and the holes in the frames, and file off flush each side. The erection is then complete; and the gear-frames, with all the blobs and gadgets attached, can be replaced on the engine in the location already described. The next stage will be to connect up to reversing-wheel and combination levers, which is easier, if anything, than coupling up the Walschaerts gear.

Lobby Chat—More Ancient History

Now, by way of a break, let us have a word or two with recent correspondents. It's funny how old ideas come up again, either in their original or revised forms, after the lapse of years, usually from entirely different sources. This week, time of writing, I received something which recalled old times in the locomotive shops and sheds. Over fifty years and more ago, when the old fitters and shopmen wanted to clean out some otherwise inaccessible nook or cranny in the works of an engine, or any part thereof, they used to cut a couple of strips of the grade of emery-cloth we called "blueback," and glue them

together, business side out. If the resulting finger wasn't stiff enough, a strip of cardboard, or a thin sliver of wood, was glued between. Sometimes the end was left square, or else cut pointed or triangular, or maybe rounded; and it was easy to poke them into any corner. I've seen them used by the coppersmiths, the injector merchants, the Westinghouse "donkey doctor," and sundry other members both in the shops and the running sheds, and very useful they were. The gadget which the reader sent, was a revival of this idea; and he wanted to know whether I thought there would be any use for them in small locomotive work, if he made some and put them on the market. There certainly would; I used the sample right away for brightening up



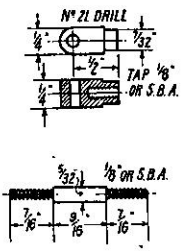
Gear connecting-rod

the flutes of a stay-bolt tap which I was just about to temper, then for the flats of a couple of pin-drills, and finally cleaned the points of the spark-plugs of the gasoline cart (I had been decarbonising her), so that sample was put to good use, anyway!

Emery sticks are, of course, used in many branches of the engineering trade, especially in instrument making. Mother had an old-fashioned steel kitchen fender, with a set of fire-irons to match, and young Curly took a delight in making them "bob," as he called it. Curly loved bright metal (and still does—I hate to see any paint on the works of a little locomotive) and to get in the corners of the intricate pattern of the front of the fender, he improvised an emery stick by cutting a strip of "Oakey" and bending it over the end of a school ruler which had become too dilapidated for use as originally intended. Again, history repeated itself, for during the short period I spent as a "Milly Amp" driver, I used exactly the same wheeze for cleaning switch contactors, except that the strip was carborundum or aloxite cloth bent over the end of a stout flat stick. For the benefit of the uninitiated, I might add that "contactors" are electrically-operated power switches, operated from a small master controller. On an electric tramway car, all the current for the motors usually passes through the controller operated by the driver, but it doesn't on an electric locomotive or motor coach; there's too much of it, so quick-acting magnetic switches are employed, operated by a small current from a master controller. All coaches of an electric train are connected by "jumpers" (multiple-wire cables with multi-plug pins and sockets for connecting) so that when the driver turns his controller handle, he switches on the "juice" to every motor in the train. Eh—what's that?—why, to be sure I could give detailed instructions for building a "Milly Amp" engine, and could also spill a few beans about I.C., but I don't poach on other folks' preserves; "live and let live" is Curly's motto. 'Nuff sed!

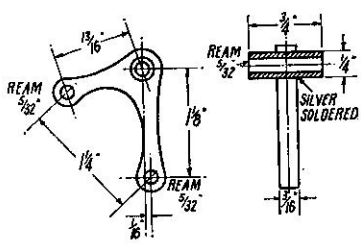
Loco. Generalities

A few readers who, like your humble servant, are great admirers of Mr. Hambleton's excellent outline drawings of the locomotives of a past era, keep on putting in requests for me to include in these notes, a few "'ints and tipses" on bringing the said engines to life. Well, by the good rights I ought to give our worthy friend who wields a pencil to such good advantage, a friendly poke in the ribs and tell him to get right on and finish the job; but I guess he is too busy building that wooden "Hardwicke" cab that he told us about! Joking apart, there should be no reason why any follower of these notes should be in difficulties in building a locomotive to any of Mr. Hambleton's outlines, so long as they use the same kind of "works," and the same arrangement of firebox and tubes in the boiler, as I have specified for an engine of similar size or type; but, be it noted, for a locomotive that is to do *real work*, you cannot include all the small details shown in the outline drawings, or make such parts as guide-bars, connecting-rods, and, in fact, any part undergoing stress and strain, in exactly similar proportion to that shown by Mr. Hambleton for the full-size engine.



Reverse-rod connection and stay-bar

I don't cater for what our worthy friend calls "locomodellers" (I have put that word in high priority on my list of "detestables"!) but for



Bell-crank

locomotive builders; that is, for good folk who build little engines for exactly the same purpose as they are built in full size, which is to do a given job of work in the most efficient manner. To do that, you cannot make a slavish copy of a full-sized engine, even with the most modern types, let alone the old-timers. To quote an instance, I am getting out a specification and drawings for Swindon's latest production, the "1000" class 4-6-0; and the C.M.E., Mr. F. W. Hawksworth, has very kindly "come to the aid of the party," as they say at Westminster, by providing some

blueprints of the full-sized engine, including the valve-gear, which, by the way, would provide a terrible shock to the good people who expound gravely about valve settings in general, and laps and leads in particular. The full-length plate frames, if reproduced exactly "to scale" for 3½-in. gauge, would only come out at a shade over $\frac{1}{16}$ in. in thickness, and have hundreds of holes for bolts and rivets which would "scale down" to the size of domestic pins. Even if built up with the eight frame stays provided on the full-sized locomotive, the frames wouldn't stand up the proverbial five minutes, to the pull-and-thrust of a pair of cylinders 1⅛ in. by 1⅞ in., with ⅝-in. piston-valves, and about 120 lb. of steam on the piston-heads when the regulator was opened. The small rivets would all come loose, and if by any mischance the engine had a buffer-stop collision, the buffer beam and the whole leading end would promptly crumple up. For that reason, my small edition has ⅛-in. plate frames, 1¼-in. steel angle buffer-beams, and a rearrangement of the staying, to suit the conditions of working in the small size.

Returning to the Hambleton drawings, if readers wish to build the "Jumbo," *Hardwicke*, they have only to turn up back numbers; for I described in full detail, how to build one of this class, "Sister Dora." A number were built, and some have been illustrated in these notes, the finest I have seen being the one built by Mr. F. M. Rummens. She is a real peach, and sails around my road notched up almost to mid-gear, blowing off with the firehole-door open, hauling a three-passenger load. She has never been tried "all out." I also described how to build the single-wheeler in 2½-in. gauge, using "Ayesha" cylinders; this was in a contemporary journal, bound volumes of which are available in the Reference Depts. of most public libraries. All being well, I will say a bit more about the old timers later on.

Letters

Burrell Compound Engines

DEAR SIR,—I am delighted that the subject of traction engines has again cropped up in the correspondence columns of THE MODEL ENGINEER. With reference to the Burrell single-crank compound engine, now that it has been definitely established that large numbers were built, I should like to raise a query on the performance of these remarkable engines. A friend of mine who is well "up" in traction engines, recently informed me that though they were good steamers and capable performers they had one serious defect, namely that quite a number of them were known to break their crankshafts. Can any reader verify this?

In conclusion, I should like to add how much I look forward to THE MODEL ENGINEER each week.

Yours faithfully,

Basingstoke. LESLIE J. SMALLBONE.

Electric Traction

DEAR SIR,—I should like to write a short reply to the various letters that have been appearing in THE MODEL ENGINEER, during the last few months, on this subject. These letters appear to be brought to a head by Mr. Gill-Knight in the issue of June 27th.

During five years in the R.A.F. at home stations, in West Africa, and in India, I have been able to give much time and thought to model railways, passenger-hauling variety, with a strong leaning towards electric traction, as a suitable type for the use of children of younger years, with simple fool-proof controls for them to work. I have seen a variety of types of locomotives, steam and electric, and the most attractive points, from a model maker's point of view, have made some very deep impressions on me.

Since my release, in February, I have nearly completed a raised track, 3½-in. gauge, quite a scenic line really, about 300 feet in length, and have now a ¾-in. "Sandringham," as well as a "made in India free-lance locomotive," to run; but my main interest, at present, is electric traction, and I am doing some experimenting.

I do not wish to make false claims, etc., so I can only say that I hope, in the course of another six or eight weeks, to let you have full details of the many trials and tribulations, which I have experienced, but which are now nearly overcome, in the completion of an entirely experimental 0-6-0 articulated 3½-in. gauge passenger-hauling locomotive, for battery operation, working on the trickle-charging at night principle.

Until then, and until I really know what sort of a performance I am getting, I must maintain a discreet silence, but felt compelled to come forward with this letter, in reply to Mr. Gill-Knight's appeal.

Yours faithfully,

Bolton. G. A. MARSHALL.

Ciné Projector Design

DEAR SIR,—In reply to Mr. Knightbridge's letter in which a four-point Maltese Cross geared down to suit a larger sprocket is suggested as a solution to the intermittent movement for substandard film, I would agree that this is mechanically possible.

There are, however, two difficulties: the inertia of the additional gears would add stresses to the movement, and a very high standard of gear-cutting would be required, together with dead concentric mounting on the shafts, and fine bearing fits in order to secure the high degree of precision required for a steady picture. The essential simplicity of the cross would be lost, but on the assumption that the necessary degree of accuracy could be obtained, it is possible that satisfactoty projection would result.

Nevertheless, the claw movement is a much simpler device for the amateur, and gives perfectly good results; and for that reason, I would still recommend it.

Yours faithfully,

Leeds. G. A. GAULD.

Clubs

The York City and District Society of Model Engineers

The next meeting will be held on August 3rd, 1946, 7 o'clock, in No. 11 Room, Co-operative Hall, Railway Street. It is known that quite a number of readers of THE MODEL ENGINEER reside in or near York, and we extend them an open invitation to come to this meeting, discuss points of interest and exchange ideas. This is what the society is for.

Hon. Secretary: WM. SHEARMAN, 28, Terry Street, York.

Croydon Society of Model Engineers

The coming of "Summer" has made little difference to the attendances at our meetings, which have followed the usual practice of formal and "go as you please" on alternate Thursdays. A recent lecture by a member, Mr. Wilson, on the construction of boats proved most interesting and helpful, especially as it was intended for the "small" man with little cash and modest workshop equipment. Another excellent item was the quarterly competition night, and it is gratifying to note the high standard of workmanship.

As an affiliated member of the S.M.E.E., the Society is running a stand at the forthcoming Exhibition, and will also be exhibiting its large "OO" gauge track in the vestibule. A great deal of very hard work has been put in by the "OO" section in carrying out renovations made necessary after six years of storage.

The Society has settled happily in its new Clubroom, but the rental is expensive, and a Sinking Fund has been started with a view to the ultimate purchase of its own premises. Each member undertakes to put a penny in the "bag" at each meeting attended. In practice this works out at very much more, and with other small profits made in various ways, the fund is growing steadily.

Hon. Secretary: L. G. BOOMER, 11, Tritton Avenue, Beddington, Croydon.

Sevenoaks and District Model Engineering Society

The re-formation of the Society took place on Wednesday, December 12th, 1945, when eighteen of us, with Mr. Evans in the chair, decided to get going again. The new constitution was adopted on February 6th, 1946, and represents our first landmark.

Since December the membership has risen to 58, the average attendance at meetings to date being 14, including visitors.

The second highlight of the six months was the exhibition at King's Hall, in which we took part, and which aroused considerable interest, and resulted in several new members.

Visits have included Crampton's Road Pumping Station, Greatness Brickworks, Tonbridge Tar and Benzol Distillery, and the trip to the R.H. & D.R. on June 30th, which ended our first six months. This last trip was a joint one with our Tonbridge friends, and about 70 members and friends took part. The weather was kind to us, and a very interesting and enjoyable time was had by all.

Meetings have been held every Wednesday evening, and activities have included preparations for the exhibition and clearing up and overhauling the plant in readiness for next season. The lighting and power circuits have recently been rewired by the Waterworks Company, and we are all set for a good run in the autumn. A stock of round bar brass, silver-steel, and bright mild-steel has been laid in, and will be available to members when the committee has fixed the prices.

As attendance at meetings has now begun to fall away, due to the fine evenings and general call of outdoor life, no more meetings will be held until Wednesday, September 11th, at 7.30 p.m., when members are asked to bring along the work on which they will have been engaged during the summer.

The Secretary is now working on the programme for the autumn and winter, and would welcome any suggestions as soon as possible. So far, three events have been fixed:—September 18th (7.30 p.m.), Annual General Meeting; September 25th (7.0 p.m. at Waterworks), Visit to Basted Paper Mills. Will members who have cars please bring them? October 30th (7.30 p.m.), Major D. H. Chaddock will talk about petrol engines. It is also hoped to have talks by Mr. R. J. Raymond, Editor of the *Model Railway Constructor*, and Mr. J. T. Holder, General Manager of the R.H. & D.R. The Secretary is trying to arrange a film show for one meeting.

As mentioned above, the annual general meeting will be held on Wednesday, September 18th, when we hope to have the President in the chair. Nominations for the committee and the various offices, and suggestions for alterations of rules, should reach the Secretary as soon as possible.

Before the war it was customary to hold an exhibition of our own every alternate year, and if sufficient support is forthcoming, it would be a fine thing to hold one next spring if sufficient support is forthcoming.

The Secretary would welcome any help in completing his Weald Manor station, so that it may be shown as a working model by the Model Railway Group of the Society. In particular about 20 point motors have to be wound.

We welcome the re-formation of the Society at Maidstone, and the proposal to form a new society at Ashford.

Hon. Secretary: L. V. RAINEY, 29, Serpentine Road, Sevenoaks, Kent. (Tel. 2125.)

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Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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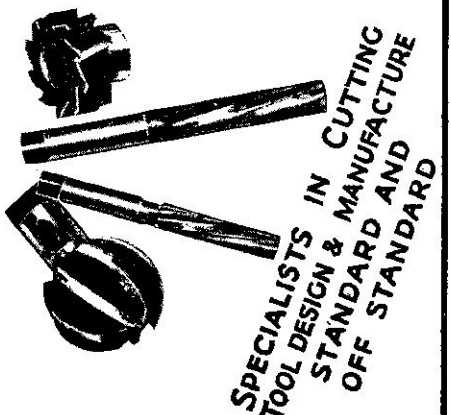

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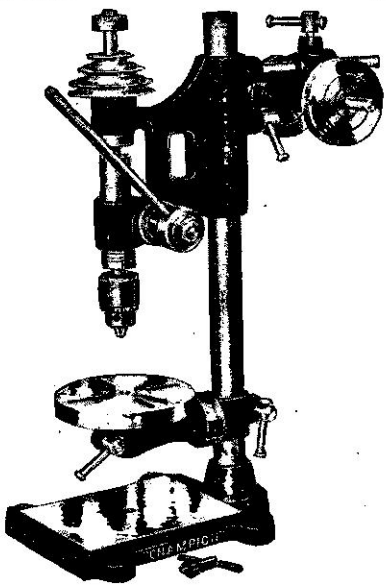

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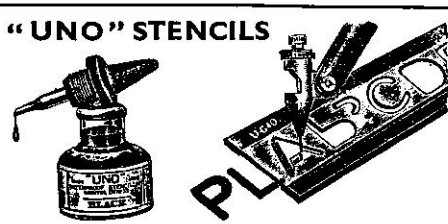

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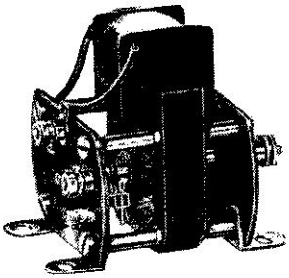

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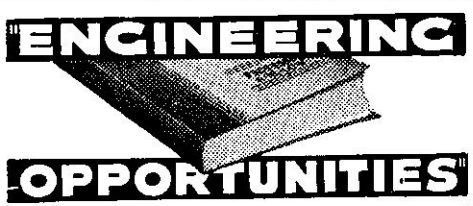

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